Hill Air Force Base, Utah

Final

Record of Decision for Operable Unit 8

March 2005

Record of Decision

Operable Unit 8
Hill Air Force Base, Utah

Prepared By:
Environmental Management Directorate
Hill Air Force Base, Utah

MARCH 2005

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

LIST OF APPENDICES

TABLE OF CONTENTS
(continued)

LIST OF TABLES
(Tables follow their respective sections)

TABLE OF CONTENTS
(continued)

LIST OF FIGURES
(Figures follow their respective sections)

LIST OF ACRONYMS

° F	degrees Fahrenheit
µg/l	micrograms per liter
1,1,1-TCA	1,1,1-trichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCA	1,2-dichloroethane
ARARs	Applicable or relevant and appropriate requirements
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CCR	Consumer Confidence Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemicals of concern
CPT	cone penetration test
CWA	Clean Water Act
DERP	DOD's Environmental Restoration Program
DERR	Division of Environmental Response and Remediation
DOD	Department of Defense
DQO	data quality objectives
EM	Environmental Management
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FFA	Federal Facility Agreement
FS	feasibility study
ft/day	feet per day
gpm	gallons per minute
HDPE	high density polyethylene
HI	hazard index
Hill AFB	Hill Air Force Base
HQ	hazard quotient
I-15	Interstate Highway 15
IC	Institutional Control
ICBM	Intercontinental Ballistic Missile
IRA	Interim Remedial Action
IRP	Installation Restoration Program

LIST OF ACRONYMS
(continued)

IWTP	Industrial Wastewater Treatment Plant
JMM	James M. Montgomery, Consulting Engineers, Inc.
LNAPL	light non-aqueous phase liquids
MAP	Management Action Plan
MCL	Maximum Contaminant Level
MCLG	maximum contaminant level goal
mg/kg	milligram per kilogram
mg/kg-day	milligrams per kilogram per day
MNA	monitored natural attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDCSD	North Davis County Sewer District
NEPA	National Environmental Policy Act
NPL	National Priorities List
NPV	Net present value
O&M	operation and maintenance
OO-ALC	Ogden Air Logistics Center
OU	operable unit
POTW	publicly owned treatment works
PRG	preliminary remediation goals
PSVP	Performance Standard Verification Plan
PSVR	performance system verification report
RAB	Restoration Advisory Board
RAO	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RfD	Reference doses
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RVMF	Refueling Vehicle Maintenance Facility
SARA	Superfund Amendment and Reauthorization Act
SF	Cancer slope factors
SVE	Soil vapor extraction
TCE	trichloroethene
TMV	toxicity, mobility, or volume
TPH	total petroleum hydrocarbons

LIST OF ACRONYMS
(continued)

UAC	Utah Administrative Code
UDEQ	Utah Department of Environmental Quality
UDWR	Utah Department of Natural Resources, Water Rights Division
USAF	United States Air Force
UST	Underground Storage Tank
VOCs	volatile organic compounds
WBWCD	Weber Basin Water Conservancy District
WSU	Weber State University

RECORD OF DECISION
FOR OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

This is a primary document for Operable Unit 8 at Hill Air Force Base. This document will be available in the Administrative Record, which will be maintained at the following locations:

Weber State University
Stewart Library
2901 University Circle
Ogden, Utah 84408-2901
Contact: Mr. Chris Hauser
Phone: (801) 626-6403

Summer Hours:	Monday through Thursday	7:00 a.m. - 8:00 p.m.
	Friday	10:00 a.m. - 6:00 p.m.
	Saturday and Sunday	1:00 p.m. - 5:00 p.m.
Winter Hours:	Monday through Thursday	7:00 a.m. - 12:00 midnight.
	Friday	7:00 a.m. - 8:00 p.m.
	Saturday	9:00 a.m. - 8:00 p.m.
	Sunday	1:00 p.m. - 11:00 p.m.

Environmental Management Directorate
OO-ALC/EMR
7274 Wardleigh Road
Building 5-NE 2nd Floor
Hill AFB, Utah 84056-5137

Hours: Monday through Friday 7:30 a.m. - 4:30 p.m.

Contact: Mr. Charles Freeman
Phone: (801) 775-6951

Final Submittal Date:

Declaration for the Record of Decision

Site Name and Location

Operable Unit 8

Hill Air Force Base

Davis County, Utah

Statement of Basis and Purpose

This decision document presents the selected remedy for Operable Unit 8 (OU 8) (OT 33) at Hill Air Force Base (Hill AFB), Utah. The remedy was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site.

The State of Utah and U.S. Environmental Protection Agency (EPA) concur with the selected remedy.

Assessment of the Site

The response actions selected in this Record of Decision (ROD) are necessary to protect public health, welfare, or the environment from actual or threatened releases of pollutants or contaminants from this site.

Description of the Selected Remedy

The selected remedy for OU 8 is part of a Basewide effort to clean up contaminated soil, surface water, and groundwater. At Hill AFB, there are twelve operable units, all of which are in different stages of investigation or cleanup. OU 8 is a groundwater only operable unit located in the southern half of the Base and extends into off-Base areas beneath the city of Layton. The selected remedy addresses both on-Base and off-Base

groundwater contamination, which consists primarily of the volatile organic contaminants trichloroethene and 1,2-dichloroethane. Potential on-Base source areas for contaminants in the OU 8 plume continue to be addressed as components of other operable units including OU 3, OU 7, and OU 9, and the Underground Storage Tank (UST) program. These source areas include: the Sodium Hydroxide Tank Site, the Industrial Wastewater Treatment Plant (IWTP) Sludge Drying beds, Berman Pond, the Refueling Vehicle Maintenance Facility (RVMF, which includes Buildings 510, 511, and 514), Buildings 220 and 225, Pond 1, and UST sites 260 (ST74) and 280 (ST35). Off-Base areas beneath the city of Layton have been impacted by on-Base groundwater migrating off-Base.

The selected remedy includes the following components:

On-Base Areas

- Implementation of monitored natural attenuation (MNA) to remediate on-Base groundwater.

- Continuous operation of the OU 8 Interim Remedial Action (IRA) Hydraulic Containment System at the southern Base boundary to prevent further migration of contaminated groundwater to off-Base areas and, as a secondary objective, contaminant mass removal.

Off-Base Areas

- Installation of groundwater extraction systems to extract contaminated groundwater. This component also assumes the continued operation of the OU 8 IRA Hydraulic Containment System to prevent further migration of on-Base contamination to off-Base areas.

Both On-Base and Off-Base Areas

- Groundwater monitoring to monitor projected declines in contaminant concentrations

- Institutional controls.

Institutional Controls (ICs) include such actions as State water rights and use restrictions and limits on the use of federal real property. In the case of OU 8, where groundwater is the only contaminated media being addressed, the objective of these controls is to prevent access or use of the ground water until cleanup levels are met. These restrictions will remain in place and be monitored for effectiveness until the concentration of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and exposure.

The selected remedy for OU 8 addresses the principal threats posed by the site by minimizing or preventing direct contact with contaminated groundwater, and by active contaminant mass removal through groundwater extraction. Further, the selected remedy prevents further off-Base transport of contaminants through continuous operation of the IRA Hydraulic Containment System.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and State of Utah requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. The remedy addresses potentially unacceptable risks to human health and the environment at both on-Base and off-Base areas.

This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for the on-Base area and satisfies the statutory preference for remedies employing treatments that reduce toxicity, mobility, or volume as a principal element. The toxicity and volume of contaminants in the on-Base area is expected to be reduced by natural processes (and through extraction of contaminated groundwater by the IRA Hydraulic Containment System) rather than through treatment as a principal remedial element. The off-Base area remedial activities will reduce the total mass of contaminants in the groundwater at OU 8, which in turn will help the naturally occurring remediation processes to address residual contamination. A review will be conducted

within 5 years of commencement of remedial actions to ensure that the remedy continues to protect human health and the environment.

If groundwater cleanup levels cannot be achieved, as determined from the results of the five-year review, the following long-term measures may be implemented as a modification to the existing system, for an indefinite period of time:

- Any other remedial technologies, including innovative technologies such as in-situ bioremediation, permeable reactive barriers, etc., for groundwater restoration.

- Seeking non-MCL level cleanup provisions of Utah Administrative Code (UAC) R315-101 and R311-211

The decision to invoke any or all of these measures will be made during a periodic review of the remedial action, which will occur at least every 5 years in accordance with CERCLA Section 121(c). During this process Hill AFB will continue to evaluate innovative technologies that may reduce remediation timeframe and cost. The results of the five-year review will be documented in the Performance Standard verification Report (PSVR) and in the five-year review report. The PSVR may also be used as a basis to invoke these changes if the time period for the PSVR is other than five years (i.e., not coincident with the five-year review).

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

for Jamie Wong — 8/5/05

Max H. Dodson, — DATE
Assistant Regional Administrator
Office of Ecosystems Protection and Remediation
EPA Region VIII

STATE OF UTAH
DEPARTMENT OF ENVIRONMENTAL QUALITY

Dianne R. Nielson

Dianne R. Nielson, Ph.D.,
Executive Director

7/29/05
DATE

STATE OF UTAH
DEPARTMENT OF ENVIRONMENTAL QUALITY

Dianne R. Nielson

Dianne R. Nielson, Ph.D.,
Executive Director

7/29/05

DATE

75th AIR BASE WING
HILL AIR FORCE BASE, UTAH

SHARON K. G. DUNBAR, Colonel, USAF
Commander, 75th Air Base Wing

13 Jul 05
DATE

Section 1

Site Name, Location, and Description

1.0 SITE NAME, LOCATION, AND DESCRIPTION

1.0.0.1. Hill Air Force Base (Hill AFB) is located in northern Utah, approximately 25 miles north of Salt Lake City and five miles south of Ogden, as shown in Figure 1-1. The Base occupies approximately 6,700 acres in Davis and Weber counties. The Base is bounded on the north by the Davis-Weber Canal, a privately owned irrigation canal, and on the east by private property. Interstate 15 and State Route 193 form the western and southern boundaries of the Base, respectively. OU 8 is one of twelve Operable Units at Hill AFB, and as shown in Figure 1-2, is located in the southern portion of Hill AFB.

1.0.0.2. Operable Unit (OU) 8 was created in 1993, and comprises the shallow groundwater aquifer beneath OU 3 and OU 7, the Industrial Complex Area of the Base, and off-Base areas beneath the cities of Layton and Clearfield (see Figure 1-3). Potential sources include Buildings 220 and 225 (OU 7); the former Berman Pond, the Hill AFB Industrial Wastewater Treatment Plant (IWTP) Sludge Drying Beds, the Sodium Hydroxide Tank Site, the Refueling Vehicle Maintenance Facility (RVMF), Ponds 1 and 3 (OU 3); and the UST sites 260 (ST74) and 280 (ST35). Each of these potential source areas has been addressed under separate investigations and decision documents. Remedial actions for OUs 3 and 7 are in place or being implemented while OU 9 sites are currently being identified and investigated. Known underground storage tank (UST) sites overlying the OU 8 plume are either under long-term operation and maintenance or have been remediated and are closed.

1.0.0.3. Contaminants, principally trichloroethene and 1,2-dichloroethane, have migrated from suspected on-Base source areas to off-Base areas within the City of Layton. Historically, shallow field drains used for agricultural purposes have transported shallow contaminated groundwater to previously uncontaminated areas. At present, the groundwater plume associated with the suspected on-Base source areas has migrated approximately 11,000 feet beyond the south Base boundary. The total acreage of the plume is currently estimated at 600 acres, with 300 acres in on-Base areas and 300 acres in off-Base areas. The off-Base portion of the plume underlies residential, commercial, and agricultural use properties. Three schools are located in the area: Lincoln Elementary, North Layton Junior High School, and Northridge High School (see Figure

1-3). Weber State University is also constructing a satellite campus in the area. A hospital (Davis Medical Center) is located near the southwest extent of the off-Base plume, west of Interstate Highway 15 (I-15).

1.0.0.4. Depth to groundwater varies significantly across the area overlying the contaminant plume. On Base, depth to groundwater varies from 70 feet below ground surface (bgs) at the southern Base boundary to 180 feet bgs at the northern extent of the on-Base plume. Depth to groundwater in the off-Base areas varies from 1 to 3 feet bgs in the plume area immediately east of I-15, to 75 feet bgs in the area west of Main Street in Layton. Groundwater on Base generally flows to the north/northwest, and to the southwest off Base.

1.0.0.5. The Davis-Weber Canal, which is located off-Base as shown in Figure 1-3, is a privately-owned irrigation canal that supplies water for irrigation diverted from the Weber River from mid-April to mid-October. The canal is concrete-lined in the area of OU 8. Based on groundwater level measurements in monitoring wells located in close proximity of the canal, the influence of the canal on the shallow groundwater at OU 8 appears to be minimal.

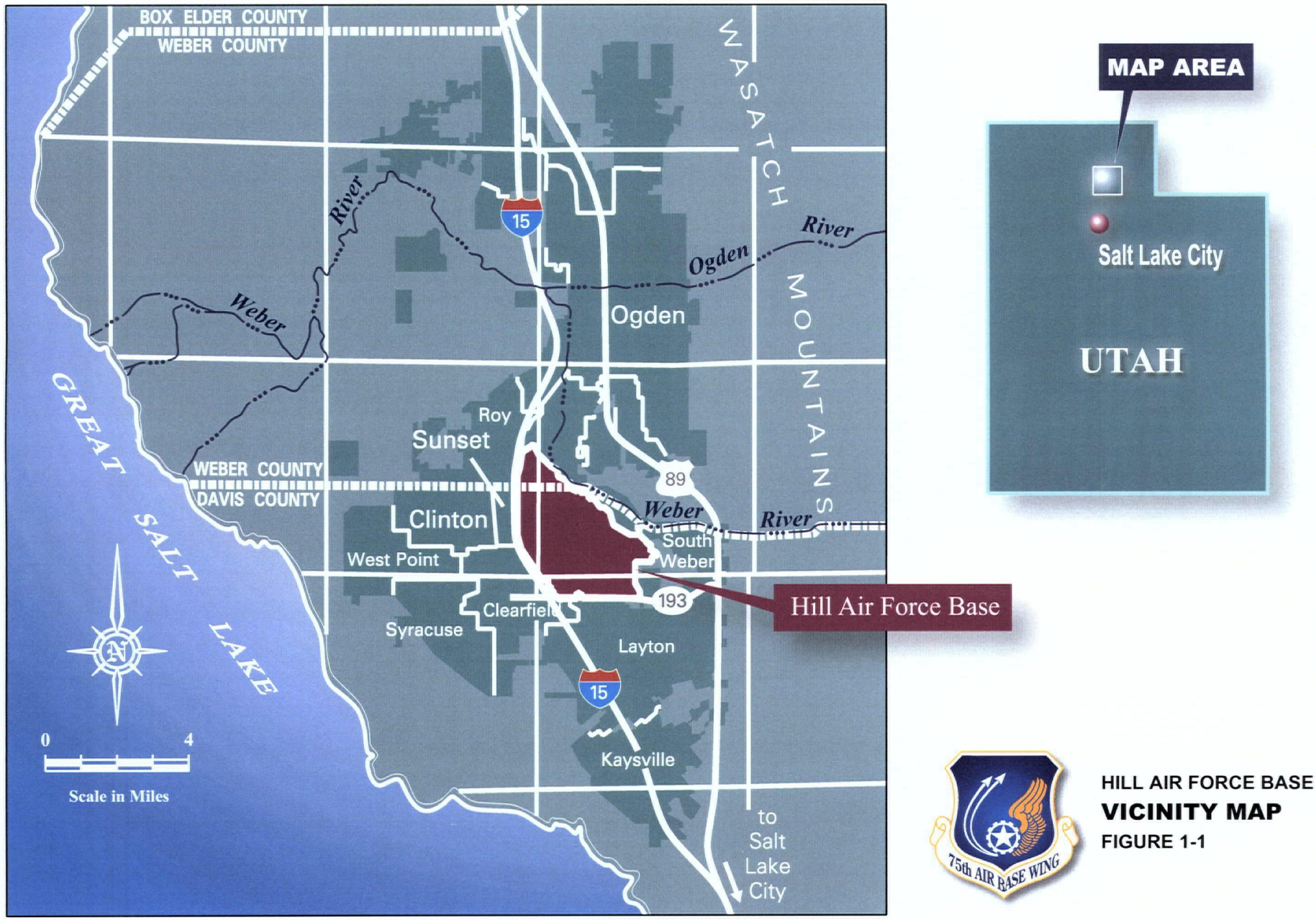
1.0.0.6. Shallow groundwater is not currently used as a source of drinking water in the area. Five residents have or do use the shallow groundwater for irrigation or stock-watering purposes only (Montgomery Watson Harza, 2001). The Weber Basin Water Conservancy District supplies municipal water to the City of Layton. The district provides water from wells that tap deep aquifers that are unaffected by contaminants associated with OU 8. There are currently five known water supply wells located within or in close proximity to the OU 8 area of investigation. Groundwater from these wells is regularly monitored to ensure the integrity of the drinking water supply.

1.0.0.7. There are no jurisdictional wetlands, as designated by the U.S. Army Corps of Engineers, within the OU 8 area. In addition, the OU 8 area is highly developed and does not provide critical or important habitats for any wildlife species, and no threatened or endangered species are known to inhabit the area. There are no uses or known

occurrences of commercially valuable natural resources within the OU 8 area, with the exception of deeper drinking water aquifers.

1.0.0.8. Operable Unit 8 has an interim remedial action (IRA) in place for the containment and extraction of contaminated groundwater at the southern Base boundary. The objective of the IRA system is to induce a hydraulic gradient that will contain contaminated groundwater migrating off-Base at the southern boundary of Hill AFB. The system has been in operation since May 1998, is planned to be in operation at least until the final remedy for OU 8 is implemented, and, as proposed in this Record of Decision (ROD), is planned for incorporation into the final remedy. Data collected to date indicate that sufficient drawdown has been maintained to achieve hydraulic containment of groundwater at the southern Base boundary in the vicinity of the system. The system is described in more detail in Section 2.3.7.

FILE 1_1 vicinmap305.ai 03/16/05



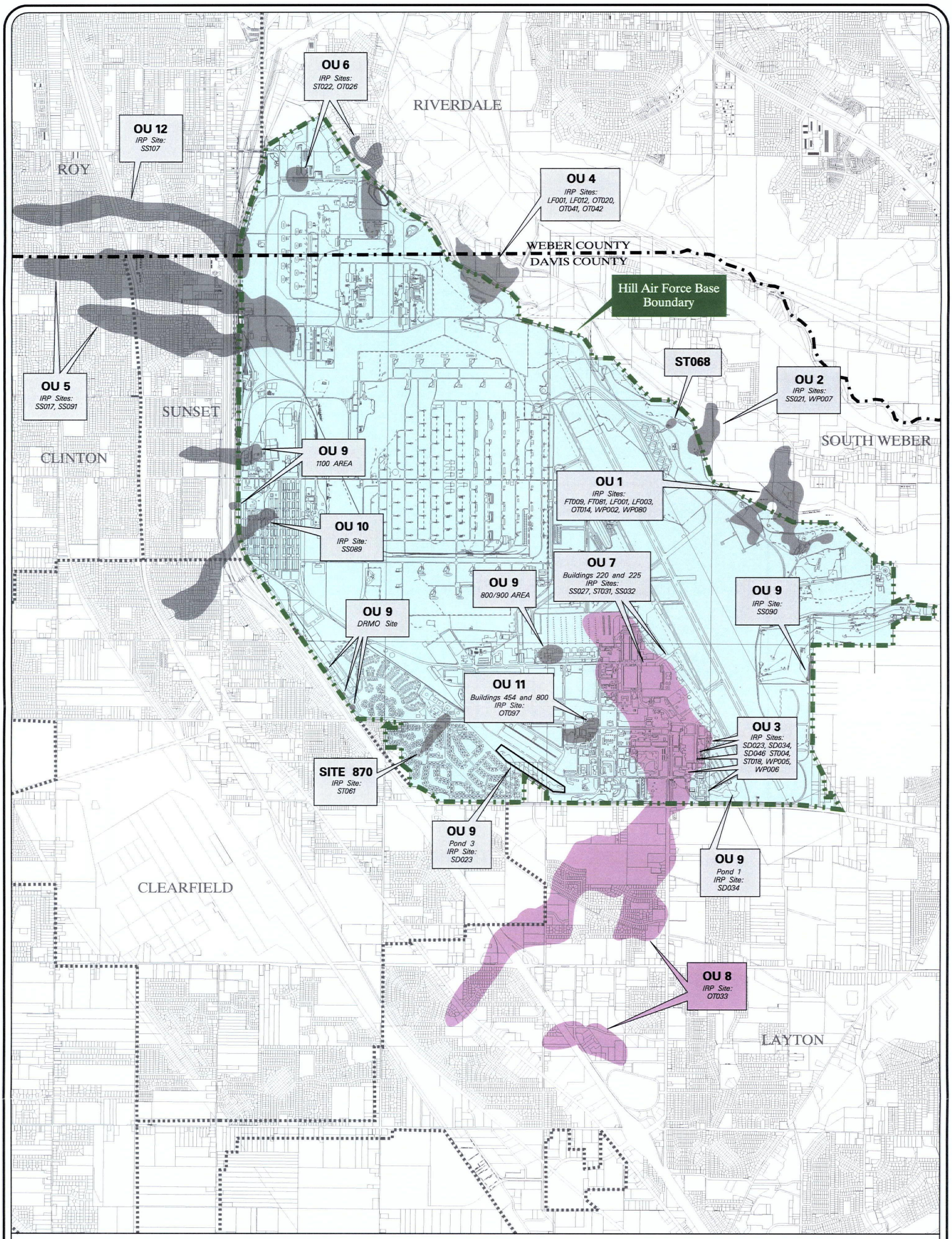
75th AIR BASE WING

HILL AIR FORCE BASE

VICINITY MAP

FIGURE 1-1

FILE I:\hill_afb\dgn\ou8\8ROD3_05\1_02ouloc8_305.dgn PLOT DATE/TIME 16-MAR-2005 16:24



EXPLANATION

- Areas of OU 8 groundwater contamination
- Areas of other Hill AFB investigations
- OU 8 investigation area
- Other operable units

NOTE: Colored areas (● ●) indicate groundwater contamination above Utah water quality standards or MCLs

N

0 1000 2000 3000 4000

Scale in Feet

75th AIR BASE WING

HILL AIR FORCE BASE

ACTIVE HILL AIR FORCE BASE IRP SITE INVESTIGATION AREAS

FIGURE 1–2

FILE I:\hill_afb\dgn\ou8\8ROD3_05\1_03_8site305.dgn PLOT DATE/TIME 16-MAR-2005 16:26

EXPLANATION

1,2-DCA plume

City boundary

Extraction well

Underground storage tank location

Former pond site; presently filled and capped or not in use

OU 8 TRICHLOROETHENE (TCE) CONCENTRATIONS IN GROUNDWATER (2001-2003)

5-10 ug/l

10-100 ug/l

100-1,000 ug/l

LOCATION MAP

MAP AREA

HILL AIR FORCE BASE

OPERABLE UNIT 7
Building 220

Building 43

ST50 Bldg. 204

ST37 Bldg. 214

ST65 Bldg. 236

ST63 Bldg. 837

Building 272 (demolished)

ST64 Bldg. 228

OPERABLE UNIT 7
Building 225

Building 257

ST74 Bldg. 260

ST35 Bldg. 280

OPERABLE UNIT 3
RVMF
Buildings 511 and 514

ST36 Bldg. 510

OPERABLE UNIT 11
Building 454 (demolished)

OPERABLE UNIT 3
Sodium Hydroxide Tank Site

OPERABLE UNIT 3
Industrial Wastewater Treatment Plant (IWTP) Sludge Drying Beds

Hill Air Force Base Boundary

OPERABLE UNIT 9
Pond 3
Previously Operable Unit 3

OPERABLE UNIT 3
Berman Pond

ST44 Bldg. 598

Pond 2

WEBER STATE UNIVERSITY BOUNDARY

OPERABLE UNIT 9
Pond 1
Previously Operable Unit 3

NEW WEBER STATE UNIVERSITY CAMPUS LOCATION

IRA CONTAINMENT SYSTEM (See Detail A)

Clearfield High School

15

CLEARFIELD

Northridge High School

Davis - Weber Canal

North Layton Junior High School

Main Street

Lincoln Elementary

LAYTON CITY

Hill Field Road

Layton Hills Mall

N

0 600 1200

Scale in Feet

75th AIR BASE WING

HILL AIR FORCE BASE
OPERABLE UNIT 8

SITE MAP

FIGURE 1-3

Section 2

Site History and Enforcement Activities

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 HISTORY OF SITE ACTIVITIES

2.1.0.1. A variety of ongoing industrial operations support the missions of Hill AFB, including metal plating, degreasing, paint stripping, painting, sounding, and other operations associated with aircraft, missile, and vehicle repair and maintenance. These industrial operations used or generated numerous chemicals and wastes, including chlorinated and non-chlorinated solvents and degreasers, petroleum hydrocarbons, acids, bases, metals, and other chemicals. These chemicals and their associated waste products were historically disposed of at the IWTP, chemical disposal pits, or landfills on the Base or at other Air Force facilities. The Environmental Restoration Management Action Plan (MAP) (MWH, 2002) presents a summary of the historical operations conducted at Hill AFB and wastes associated with those activities. Hazardous wastes currently generated at Hill AFB are managed (i.e. stored, treated, and disposed of) according to the requirements of the Resource Conservation and Recovery Act of 1976 (RCRA).

2.1.0.2. History. Former occupants of the area now known as Hill AFB included the Ogden Arsenal and the Ogden Air Depot. The Ogden Arsenal, located in the western portion of Hill AFB, was activated in 1920 as an Army Reserve depot. The Arsenal comprised approximately 3,300 acres with numerous buildings and storage magazines used to store ordnance for emergency use and unused ordnance from World War I. During World War II, the Arsenal manufactured bombs, artillery shells, and small-arms munitions and became a distribution center for motorized equipment, artillery, and general ordnance. Manufacturing operations ceased in 1945, and the Arsenal was used as a storage and distribution depot for vehicles, artillery, small arms, parts, and supplies. The Ogden Air Depot commenced operations in 1940 as the Rocky Mountain Air Depot. The depot was later named Hill Field in honor of one of its early pilots, Major Ployer P. Hill. In 1948, following the creation of the United States Air Force (USAF) as a separate military service, Hill Field was officially renamed Hill Air Force Base.

2.1.0.3. In 1955, the Ogden Arsenal was transferred from the U.S. Army Reserves to the USAF. This doubled the size of Hill AFB and added approximately 600 buildings and structures to the Base. In addition to growing in acreage, the Base expanded its array of responsibilities. Hill AFB was assigned logistical and management responsibilities for various weapons systems and aircraft.

2.1.0.4. Hill AFB is currently home to the Ogden Air Logistics Center (OO-ALC), one of three air logistics centers that make up the Air Force Materiel Command. Two additional centers are presently undergoing realignment/closure. The OO-ALC is composed of four major groups: the Directorate of Aircraft, the Directorate of Intercontinental Ballistic Missile (ICBMs), the Directorate of Commodities, and the Directorate of Technology and Industrial Support. There are 10 support organizations, including the Directorate of Environmental Management and a number of tenant organizations, including two fighter wings.

2.1.0.5. CERCLA Regulatory History. As far back as the 1970s, Hill AFB made compliance with applicable environmental regulations a priority in its Base operations. Since 1984, the Air Force has committed significant resources to assess and remediate environmental contamination identified at Hill AFB. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) established a national program for responding to releases of hazardous substances into the environment. In anticipation of CERCLA, the Department of Defense (DOD) developed the Installation Restoration Program (IRP) to respond to releases of toxic or hazardous substances at DOD facilities. Hill AFB was already engaged in the IRP when it was placed on the Environmental Protection Agency (EPA)'s National Priorities List (NPL), or "Superfund" Program, in July of 1987.

2.1.0.6. The Superfund Amendment and Reauthorization Act (SARA), enacted in 1986, requires that federal facilities follow National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requirements. In addition, the program requires greater EPA involvement and oversight of federal facility cleanups. The IRP follows these requirements. In response to SARA, the EPA developed the *Guidance for Conducting*

Remedial Investigations and Feasibility Studies Under CERCLA (EPA, 1988). This document was used as guidance for the Remedial Investigation Report for OU 8.

2.1.0.7. Federal Facility Agreement. Hill AFB had conducted most of its environmental restoration activities under the Federal Facility Agreement (FFA) that was signed in April of 1991 by the Air Force, EPA Region VIII, and the Utah Department of Environmental Quality (UDEQ; formerly the Utah Department of Health). The purpose of the agreement was to establish a framework and schedule for developing, implementing, and monitoring appropriate remedial actions at Hill AFB. The FFA was signed pursuant to numerous authorities under relevant regulatory jurisdictions, including, but not limited to, CERCLA, RCRA, NCP, Clean Water Act (CWA), National Environmental Policy Act (NEPA), and the DOD's Environmental Restoration Program (ERP) - formerly DOD's Environmental Restoration Program (DERP). Additional regulatory history and current regulatory framework details can be found in the MAP (MWH, 2002).

2.2 DESCRIPTION AND HISTORY OF OPERABLE UNIT 8

2.2.0.1. Operable Unit 8, which is shown in Figure 1-3, is located in the southern portion of Hill AFB, and comprises groundwater underlying the Industrial Complex Area of the Base and the off Base cities of Layton and Clearfield. Operable Unit 8 was created in 1993, and consists of contaminated ground water previously considered part of OU 3 and OU 7. While remedial actions have already been selected and implemented for both OU 3 and OU 7, certain sites previously investigated under OU 3 are currently investigated under OU 9. Contaminated ground water currently encompasses approximately 600 acres. Additionally, several UST sites that were investigated for potential ground-water contamination are located within the OU 8 area, as shown in Figure 1-3. Brief site histories of OUs 3 and 7 and the USTs within OU 8 that have contaminated ground water are presented in the following paragraphs.

2.2.0.2. Operable Unit 3. Operable Unit 3 originally consisted of soil, sediment, and surface water in the vicinity of Berman Pond, the Sodium Hydroxide Tank Site, IWTP Sludge Drying Beds, Pond 1, Pond 3, and the RVMF (Buildings 510, 511, and 514).

These areas are shown in Figure 1-3. The remedial investigation (RI) at OU 3 began in January 1987. Initial field investigations for the RI, conducted in 1988, indicated that more data were needed to define the extent of contamination. Additional fieldwork was conducted in 1990 and 1991. A baseline risk assessment for OU 3 was prepared as part of the RI, and the report was submitted as a separate document from the RI report James M. Montgomery, Consulting Engineers, Inc. (JMM, 1991a). The Draft Final RI Report was submitted in April 1992 (JMM, 1992a). Focused Remedial Investigation/Feasibility Study (RI/FS) investigations were conducted for the Sodium Hydroxide Tank Site and the RVMF (Montgomery Watson, 1993b). An interim ROD was signed for the sodium hydroxide site in September 1992 (Hill AFB, 1992). The interim remedial action described in the ROD involved the installation of an asphalt cap at the sodium hydroxide tank site in August 1993. Phase II of the OU 3 RI was initiated in 1992, and was completed in 1994. Phase II of the RI was performed to fill data gaps, and included further investigation of the nature and extent of soil, ground water, and surface water contamination, as well as contaminant transport pathways.

2.2.0.3. Feasibility studies (FS) were conducted at OU 3 from 1992 through 1995, when the Final RI/Baseline Risk Assessment Addendum and Final FS for OU 3 were presented. The final ROD was signed in October 1995. A dewatering system treatability study at Berman Pond was implemented that year and was included as part of the final ROD. The Final Remedial Design Report and Work Plan were presented in 1997, and remedial actions continued until the Final Remedial Action Project Close-Out Report for OU 3 was completed in April of 1999. Asphalt capping of Berman Pond, and soil vapor extraction at the RVMF was implemented between 1997 and 1998. A Final Inspection, Operations, and Maintenance Plan for the CERCLA cap system was completed in May 1999. As it now stands, long-term operations and maintenance (O&M) at OU 3 is scheduled to continue until at least 2049. The RVMF soil vapor extraction (SVE) system was operated until September 1998 and compliance sampling demonstrated attainment of remediation goals and the system is now shut down. Pond 1 is currently being investigated as part of OU 9.

2.2.0.4. Operable Unit 7. Operable Unit 7 is comprised of Buildings 220 and 225, the industrial wastewater pipe in the vicinity of Buildings 220 and 225, and backfilled soil at Base Supply Well 6. In 1989, Montgomery Watson began site investigation activities at OU 7 for a portion of Building 225 and for Base Supply Well 6. The former source areas within OU 7 are shown in Figure 1-3. The results of these activities were presented in the *Final Site Characterization Report for a Portion of Building 225 and Site Investigation of Fill Soils at Base Supply Well 6* (JMM, 1991b). Montgomery Watson began RI fieldwork for OU 7 in 1992, and the RI/FS report was approved in 1995 (Montgomery Watson, February 1995). A ROD, which required long-term maintenance of the existing concrete floor of Building 225 and monitoring under the slabs, was signed in 1995. The Remedial Design/Remedial Action Work Plan for OU 7 was presented in 1996. No remedial actions were required as part of the OU 7 ROD at Building 220 as contaminants present in soil underlying and surrounding the building did not represent current or future health risks, and did not present a risk of contaminating ground water beneath the building. The Remedial Action Project Close-Out Report for OU 7 was completed in 1998. Long-term O&M at Building 225 is expected to continue until at least 2049.

2.2.0.5. The remedial action for OU 7 consists of annual inspection and maintenance of a concrete floor slab overlying chromium and cadmium contaminated soil beneath Building 225, and semi-annual groundwater quality and soil moisture monitoring. Results of these activities are reported in the *Plan and Report Repository – Operable Units 3, 4 & 7* (URS, 2000).

2.2.0.6. Underground Storage Tank Program. The UST sites within OU 8 (with existing monitoring wells) include Sites 204 (ST50), 214 (ST37), 228 (ST64), 236 (ST65), 260 (ST74), 280 (ST35), 510 (ST36), 598 (ST44), and 837 (ST63), which are shown in Figure 1-3. The USTs are not regulated under CERCLA, but subsurface data collected through the UST investigations will be used to assist with the OU 8 characterization. Details of the completed UST investigations are presented in a series of Corrective Action Plans and Site Characterization and Subsurface Investigation Reports. Based on these reports, only UST sites 260 and 280 have contaminated the underlying ground water. Ground-water samples collected from monitoring wells at sites 260 and

280 have been analyzed for diesel range and gasoline range compounds. Figure 2-1 shows areas where light non-aqueous phase liquids (LNAPL) have been detected within OU 8.

2.3 EXISTING REMEDIAL ACTIONS/CORRECTIVE MEASURES

2.3.0.1. Several remedial actions or corrective measures have been implemented within the OU 8 area for groundwater and for source areas. These remedial actions/corrective measures were undertaken to control the known sources of groundwater contamination at OU 8. These remedial actions include containment of contaminated OU 8 groundwater at the southern Base boundary as part of an interim remedial action, implementation of the OU 3 and 7 RODs, implementation of interim remedial measures at the Sodium Hydroxide Tank Site (now included in the OU 3 ROD), and implementation of corrective actions at UST Sites ST35 (Building 280) and ST74 (Building 260). The following paragraphs provide a brief description of these actions and present a detailed description of the OU 8 IRA implemented at the Base boundary.

2.3.1 Sodium Hydroxide Tank Site

2.3.1.1. To control exposure to contaminated soil and to minimize the potential for contaminants from this site migrating to the underlying groundwater, the site was covered with an asphalt cap in August 1993 as an interim remedial measure. This original cap was re-paved in September 1999. This site is currently under long-term maintenance and monitoring consisting of annual inspection and monitoring and semi-annual groundwater monitoring.

2.3.2 Berman Pond

2.3.2.1. To prevent further contamination of groundwater and to prevent exposure to contaminants within Berman Pond, an asphalt cap was installed over Berman Pond and an extraction system was installed within the pond to remove the perched water present within the contaminated soil. These remedial actions were in place by July 1998, and this

site is currently under long-term monitoring and maintenance consisting of annual inspection, groundwater elevation monitoring, and semi-annual groundwater monitoring.

2.3.3 RVMF (Buildings 514 and 511) Area

2.3.3.1. To reduce concentrations of 1,1-DCE in soil at this site (i.e., at Building 514), a soil vapor extraction system was installed and operated from September 1997 through September 1998. Confirmation sampling indicated that cleanup goals were achieved, and no further action is required at this site.

2.3.4 Building 225

2.3.4.1. The principal contaminants associated with Building 225 are hexavalent chromium (at concentrations up to 1,600 milligram per kilogram [mg/kg]) and cadmium (at concentrations up to 62 mg/kg). The concrete floor slab of Building 225 overlies the chromium and cadmium contaminated soil detected beneath the building, and this slab was considered a good deterrent to infiltration of water through these soils. Therefore, the remedial action implemented at Building 225 consists of long-term maintenance of the concrete slab as well as moisture monitoring beneath the slab. Groundwater monitoring has indicated increasing chromium concentrations in groundwater below Building 225 with time (in monitoring well U7-012). Soil moisture monitoring beneath the slab suggests that this trend is unrelated to moisture migration through the slab floor. However, leakage from a damaged fire hydrant main in 1998 on the east side of Building 225 may have migrated vertically and transported chromium contamination perched on clay lenses beneath the building to the water table. The leaking main was repaired and chromium concentrations continue to be monitored at monitoring wells U7-008, U7-012, T228-001, and at downgradient well U7-009 to track projected declines in chromium concentrations.

2.3.5 UST Site 260 (ST74)

2.3.5.1. To remove the LNAPL layer as a continuing source of total petroleum hydrocarbons (TPH) compounds to groundwater underlying this site, free product

recovery was implemented using skimmer pumps. An increase in groundwater elevation was observed in monitoring wells at the site from April 1996 to March 1997. The cause of the increased groundwater elevations could not be determined. Free product thickness at the site decreased from 2.5 feet in September 1993 to 0.4 feet in March 1997. Due to the decreased free product thickness, free product skimming was stopped and the site was closed by the Utah Division of Environmental Response and Remediation (DERR) in 1998. Regular free product monitoring at the site is currently conducted under the OU 8 remedial action program and during monthly water level measurement rounds at OU 8.

2.3.6 UST Site 280 (ST35)

2.3.6.1. To remove LNAPL detected at this site, free product abatement measures included passive free-product recovery, a skimmer pump pilot study, and a dual-phase vacuum extraction pilot study. By the end of March 1994, free product thickness had diminished to 0.015 inches in monitoring well WW-9 at the site and two years of subsequent monitoring did not indicate the presence of free product. UST Site 280 was closed by the Utah DERR in 1998. Free product beneath the site is assumed to be trapped beneath the water table as a result of groundwater elevation fluctuations. Gasoline and petroleum hydrocarbons have been detected frequently in groundwater samples collected from monitoring well WW-9. Consequently, UST Site 280 appears to be a continuing source of petroleum hydrocarbons in OU 8 groundwater.

2.3.6.2. The area around Site 280 has been developed for an aircraft maintenance hangar, and consequently, monitoring well WW-9 has been abandoned. Prior this development, free product measurements were made in monitoring WW-9 and adjacent piezometers in June 2000. No free product was detected in WW-9. Only a thin sheen of free product was detected in the piezometers. Because Site 280 is closed, groundwater contamination resulting from the presence of free-product beneath Site 280 will be addressed as part of the OU 8 remedial action program.

2.3.7 OU 8 IRA Hydraulic Containment System

2.3.7.1. In an effort to reduce the potential future risks to off-Base receptors and minimize the potential migration of contaminants, Hill AFB implemented an IRA, pending completion of a comprehensive RI and potential future remedial action for OU 8. An Interim ROD for an IRA at OU 8 was finalized in May 1997. The Interim ROD identified a groundwater hydraulic containment system as the selected remedy (Hill AFB, 1997a). The hydraulic containment system was constructed from the fall of 1997 through spring 1998, began operation in May 1998, and is planned to be incorporated into the final remedy for OU 8 and operated until site remedial action objectives are achieved.

2.3.7.2. System Objectives. Based on the remedial action objectives stated in the IRA ROD, the objectives of the hydraulic containment system are to:

- Extract groundwater to sufficiently induce a hydraulic gradient that will contain groundwater contaminated above MCLs at the southern boundary of Hill AFB
- Convey contaminated water through double-contained piping to the sanitary sewer line
- Discharge extracted groundwater containing toxic organic contaminants below permitted levels to the sanitary sewer of the North Davis County Sewer District (NDCSD)
- Detect any leakage in the conveyance system.

2.3.7.3. System Design and Components. The OU 8 Hydraulic Containment System consists of a series of eight vertical extraction wells, conveyance lines of double-walled high density polyethylene (HDPE) piping, and discharge points to the sanitary sewer system through two individual sanitary sewer manholes. The extraction wells are divided into two separate systems that operate independently, the East System and the West System, one on each side of South Gate Drive along the southern boundary of the Base.

The east system consists of three extraction wells, and the west system consists of five extraction wells. The layout of the system is illustrated in Figure 2-2. Each extraction well consists of 6-inch diameter low carbon steel casing and 6-inch diameter stainless steel screen. The depths of the extraction wells vary from 110 to 160 feet bgs with screened intervals varying from 60 to 100 feet in length, as appropriate.

2.3.7.4. Concrete vaults house the well head piping and valves, a local control panel for pump operation and signal transmission, a magnetic flow meter, a sampling port, a pressure gauge, and other fittings. Additional details of the hydraulic containment system are described in the *Report Repository, Operation and Performance Reports, Interim Remedial Action Hydraulic Containment System, Operable Unit 8*, (Hill AFB, 1999 - 2000).

2.3.7.5. System Operation and Performance. The West System has been in operation since May 1998 and has operated nearly continuously since start-up. The East System was shut down on May 21, 1998, after only four days of operation due to flooding of the electrical pullbox that resulted in electrical component damage. After several design changes and site re-grading were implemented, the East System was restarted in April 1999, and has been in nearly continuous operation since that time. The system was shut down in March 2001 for well rehabilitation and redevelopment. Extraction rates improved following this maintenance. The average flow rate for the system in 2000 was 87 gallons per minute (gpm), with individual well flow rates ranging from 1.0 gpm (at U8-207 in the eastern system) to 45.0 gpm (at U8-203 in the western system) (Hill AFB, 2001).

2.3.7.6. Hydraulic Containment. Water level data collected during operation of the IRA indicate that sufficient drawdown was achieved to maintain hydraulic containment of groundwater at the southern Base boundary. Although the hydraulic gradient in the vicinity of the West System allowed groundwater to move past the extraction wells during a 33-day shutdown period (July – August 1999), calculations referenced in the System's O&M Manual indicate that the entire system may be off-line for up to 50 days before containment would be lost. Any contaminated groundwater that moved

downgradient of the extraction wells during shutdown would be recaptured by the system after it resumes operation due to its downgradient area of influence.

2.3.7.7. To measure the impact of hydraulic containment on contaminant levels in the vicinity of the IRA, quarterly groundwater samples were collected from 12 to 14 monitoring wells located downgradient, upgradient, and crossgradient to the IRA system. The TCE concentrations detected in these monitoring wells indicate that the impact of the IRA Hydraulic Containment System operation on groundwater contaminant concentrations was not detectable in downgradient monitoring wells during the first two years of operation. In addition, no specific trends were observed in the crossgradient or upgradient wells. Quarterly groundwater sampling was also performed during the second year of system operation (reporting period July 1999 through December 1999). The analytical data are presented in the *Interim Remedial Action Hydraulic Containment System for Operable Unit 8, Annual Cost and Performance Analysis for July 1999 through March 2000* (Hill AFB, 2000). These data indicate that the impact of the IRA system operation on groundwater contaminant concentrations is not yet detectable in the downgradient monitoring wells (Figure 1-3). TCE concentrations in downgradient monitoring wells are expected to decrease during long-term monitoring; however, significant changes are not expected during initial years of system operation.

2.3.7.8. Cumulative TCE Removal. Based on total system cumulative flow and analytical data collected from the system discharge points, the cumulative mass removal estimate since the beginning of system operation in May 1998 is approximately 12 pounds, as described in the Hill AFB *Environmental Restoration Management Action Plan* (MWH, 2002). Contaminant mass removal is a direct result of extraction of groundwater containing dissolved contaminants, but is not an objective of the IRA.

2.4 INVESTIGATION HISTORY

2.4.0.1. Site investigations in the OU 8 area began in the 1980s. Investigations were previously conducted under OU 3 and OU 7 to delineate the nature and extent of suspected soil, surface water, and groundwater contamination in the southern portion of the Base. Investigations were also performed in the off-Base areas of Layton for

potential contamination. These preliminary investigations revealed potential contaminant sources within the Base area. Remedial investigations were initiated for OU 3 and OU 7 to further characterize the extent of contamination and evaluate potential downgradient receptors and transport pathways. The OU 3 RI was performed in two phases. The first phase of the OU 3 RI was completed in 1991 and results are presented in the *Draft Final Remedial Investigation Report for Operable Unit 3* (JMM, 1992). A baseline risk assessment was also prepared as part of the OU 3 RI. The second phase of the OU 3 RI was performed to fill data gaps identified in the first phase, and was completed in 1994. Results of the Phase II RI are presented in the *Final Data Summary and Recommendations Report for Operable Unit 8* (Montgomery Watson, 1995a).

2.4.0.2. Remedial investigation activities under OU 7 began in 1989 and were completed in 1993. Results of these activities are reported in the *Final Remedial Investigation Report/Feasibility Study Report for Operable Unit 7* (Montgomery Watson, 1995b). Operable Unit 8 was created in 1993, and comprises contaminated ground water previously considered part of OU 3 and OU 7. Remedial investigation activities in OU 8 began in 1993 and were completed in 2001. The results of these investigations are presented in the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001). A baseline risk assessment was also performed as part of the RI, and is included in the OU 8 RI report. Certain sites previously investigated under OU 3 are currently investigated under OU 9. Additionally, several UST sites that were investigated for potential ground-water contamination are located within the OU 8 area, as shown in Figure 1-3.

2.5 HIGHLIGHTS OF COMMUNITY PARTICIPATION

2.5.0.1. The remedy selection process was in accordance with the public participation requirements of CERCLA Sections 113(k)(2)(B)(I-iv) and 117. Additional requirements as outlined in the Hill AFB *Environmental Restoration Community Relations Plan* (Hill AFB, 1997b) were also fulfilled. In particular, Hill AFB has held several public Information Fairs in an effort to involve and inform the public on issues related to the

RI/FS process and findings. Hill AFB also holds annual meetings with Layton City officials, and meets quarterly with members of the Restoration Advisory Board (RAB).

2.5.0.2. Hill AFB held the first Information Fair for OU 8 on August 17, 1995 during design of the IRA Hydraulic Containment System. Subsequent Information Fairs related to the completion of the OU 8 RI report and the baseline risk assessment were held on April 26 and May 2, 2001 at the North Layton Junior High School in Layton, Utah. The RI report for OU 8 was made available to the public in December 2001. As part of the CERCLA process, a FS was performed following completion of the OU 8 RI. The FS report was made available to the public in March 2003. Both the RI and FS documents were mailed to the federal, state, and local agencies, Administrative Record repositories, and interested parties, a list of whom is maintained by Hill AFB. These documents can be found in the Administrative Record file and the information repository located at the Directorate of Environmental Management at Hill AFB and at the Weber State University library in Ogden, Utah.

2.5.0.3. The Proposed Plan for OU 8 was made available for public comment in June 2003. The notice of availability of the Proposed Plan was published in the *Salt Lake Tribune*, *Ogden Standard Examiner*, *Hilltop Times*, and *Deseret News*. The public comment period ran from June 23 to July 22, 2003. An open house format public meeting was held on July 10, 2003 at the Northridge High School in Layton, Utah.

2.6 SCOPE AND ROLE OF OPERABLE UNIT 8 WITHIN SITE STRATEGY

2.6.0.1. Response actions at Hill AFB are structured into twelve OUs. Most of the OUs are geographically defined (though some are delineated on the basis of contaminated media) and where appropriate, address all contaminated media within each unit. Remedial actions are addressed separately for each OU, and each unit is at different stages of investigation or remediation.

2.6.0.2. This ROD addresses groundwater contamination only at OU 8, which includes contaminated groundwater previously investigated under OU 3 and OU 7, and the UST sites. Other contaminated media in OU 3 and OU 7 were addressed in the respective

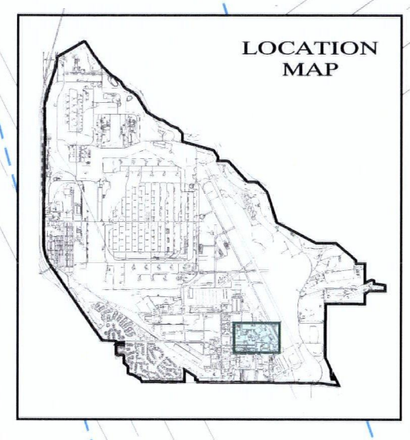
ROD documents for those OUs. Various response actions have been implemented at OUs 3 and 7, and at the UST sites. In addition, the IRA Hydraulic Containment System has been implemented at OU 8 as an interim action. The selected remedy for OU 8 incorporates or builds on these prior response actions, which will continue as part of this remedy.

2.6.0.3. Naturally occurring remediation processes will reduce concentrations of contaminants on Base, and hydraulic containment at the IRA will prevent further migration of contaminants from suspected on-Base source areas to off-Base areas. Institutional controls will prevent potential use of shallow contaminated groundwater, and prevent accidental contact with the contaminated groundwater. Active groundwater extraction in the off-Base area will reduce contaminant concentrations as a result of contaminant mass removal. Institutional controls will prohibit the potential for use of shallow contaminated groundwater.

PLOT DATE/TIME 16-MAR-2005 16:35

I:\hill_afb\dgn\ou8\8ROD3_05\2_01_8lnapl305.dgn

FILE



4th Street

6th Street

Southgate

Parking Lot

"A" Lane

Engine Lane

Arnold Drive

B Street

Ave.

4650'

4700'

4680'

U8–011

U8–108

U8–617

U8–018 (destroyed)

U8–205

U8–615

U8–017

U8–616

WW–13

T–228–001

ST64
228

U9–006

U8–056

U8–055

U9–003

T–260–001

ST74
260

WW–11

WW–10

WW–9
(abandoned)

U3–054

U8–013

U8–012

U8–107

U3–056

U9–001

T–510–001

ST35
280

ST36
510

0 100 200

Scale in Feet

EXPLANATION

- Monitoring well
- Extraction well
- 4700' Groundwater contour (March 1998 data)
- Groundwater flow direction
- Location of LNAPL plume (January 1994)
- Location of LNAPL plume (October 1994)

HILL AIR FORCE BASE
OPERABLE UNIT 8

HISTORICAL LNAPL PLUMES

FIGURE 2–1

PLOT DATE/TIME 16-MAR-2005 16:37

I:\hill_afb\dgn\ou8\8ROD3_05\2_02_8syslay305.dgn

FILE

EXPLANATION

- Piezometer
- Extraction well
- Monitoring well
- Concrete vault
- Electrical pullbox
- HDPE double-contained conveyance line

(a) The West System Collection Vault also houses controls and instrumentation for Well U8-209

(b) The East System Collection Vault also houses controls and instrumentation for Well U8-208

N

0 50 100

Scale in Feet

N281600 N281400 N281200 N281000 N280800

E1869200 E1869400 E1869600 E1869800 E1870000 E1870200 E1870400 E1870600

WEST SYSTEM

EAST SYSTEM

West System Collection Vault (a)

West System Discharge Point

Sump pump conveyance line

Leak detection sensor

East System Discharge Point

Sump pump conveyance line

East System Collection Vault (b)

Leak detection sensor

Building 565 West System Main Control Panel

Building 599 East System Main Control Panel

P564 P565 P599

513

MH-7 MH-9 MH-21

TRANSFOMER BOX

CONC BOX

WELL

IW/MH

MH

Electrical pullbox

U8-103 U8-104 U8-046 U8-102 U8-603 (aband) U8-604 (aband) U8-052 U8-948 U8-634 U8-051 U8-203 U8-602 (aband) U8-635 U8-632 U8-211 U8-631 U8-633 U8-630 U8-628 U8-629 U8-210 U8-626 U8-627 U8-606 (aband) U8-605 (aband) U8-607 (aband) U8-142 U8-024 U8-202 U3-043 U8-949 U8-625 U8-624 U8-209 U8-950

U8-208 U8-048 U8-105 U8-951 U8-952 U8-207 U8-609 (aband) U8-608 (aband) U8-201 U8-610 (aband) U8-953 U8-047 U3-031 U3-002

U8-066 U8-065 U8-058 U8-070

4750

Jogging Path

Perimeter Security Fence

Highway 193

Hill Field Road

Sign

HILL AIR FORCE BASE
OPERABLE UNIT 8

IRA HYDRAULIC CONTAINMENT SYSTEM LAYOUT

FIGURE 2-2

Section 3

Summary of Site Characteristics

3.0 SUMMARY OF SITE CHARACTERISTICS

3.1 TOPOGRAPHY AND HYDROGEOLOGY

3.1.0.1. Hill AFB lies on a terrace approximately 300 feet above the Weber River Valley. The hydrogeology at OU 8 is complex and includes several possible migration pathways in the shallow aquifer. Contaminants have migrated from on-Base sources to other on-Base areas, as well as to off-Base areas. The principal route of contaminant migration is by flow through the shallow aquifer, which consists of complexly interbedded mixtures of sands, silty sands, and silty clay. After entering the shallow aquifer, contaminants migrate horizontally and vertically through the higher permeability sand and silty sand units that constitute preferential pathways in the shallow aquifer stratigraphy.

3.1.0.2. On Base at OU 8, a northwest-southeast trending zone of relatively higher permeability sands appears to control contaminant migration. Off Base, higher permeability sand units interbedded within finer-grained silty clays appear to control migration of contaminants. A laterally extensive layer of relatively lower-permeability clay and silty clay underlies these units and impedes vertical migration. In addition, hydraulic gradients (both upward and downward) exist within various portions of the shallow aquifer and affect the vertical distribution of contaminants. On Base, groundwater flows mostly west to northwest, while off-Base groundwater flows mostly to the south-southwest.

3.1.0.3. The calculated groundwater velocities in the shallow aquifer vary significantly across OU 8, ranging from 0.002 feet per day (ft/day) to 34 ft/day. Over half of the calculated groundwater velocities from on-Base locations are less than 0.2 ft/day, with a mean velocity of 1.7 ft/day. Some of the highest velocities on Base occur near wells screened in sand units, which may be representative of the flow rates within preferential pathways in the shallow aquifer. Calculated average linear velocities off Base appear to be higher than on-Base values, having a median velocity of 0.6 ft/day and a mean velocity of 4.7 ft/day. This is likely due to the higher hydraulic conductivity values coupled with higher hydraulic gradients encountered off Base.

3.2 NATURE AND EXTENT OF CONTAMINATION

3.2.0.1. As described in the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001), volatile organic compounds (VOCs) are the primary contaminants detected in OU 8 groundwater. The VOCs most frequently detected above their respective maximum contaminant levels (MCLs) in OU 8 groundwater include: trichloroethene (TCE), 1,2-dichloroethane (1,2-DCA), 1,1-dichloroethene (1,1-DCE), 1,1,1-trichloroethane (1,1,1-TCA), and chlorobenzene. In addition, gasoline and diesel range organic compounds (benzene, ethylbenzene, and toluene) have been detected at concentrations exceeding their respective MCLs near on-Base UST sites. All organic contaminants have been detected within the areal extent of the TCE and 1,2-DCA plumes. Table 3-1 presents the historical maximum concentrations of organic compounds detected in OU 8 groundwater, and their respective MCLs. In addition, Table 3-1 provides the most recent concentrations for each contaminant. Several inorganic contaminants have been detected sporadically in groundwater above their respective MCLs, including hexavalent chromium, arsenic, antimony, cadmium, nickel, and lead in the vicinity of Building 225 and the IWTP.

3.2.0.2. The most widespread contaminants at OU 8 are TCE and 1,2-DCA. The highest TCE concentrations are observed on Base near and downgradient of Building 257, the RVMF area (Buildings 511 and 514), and Building 225 (see Figure 1-3). Historically, the highest TCE concentration reported was 2,000 micrograms per liter (µg/l) in monitoring well WW-13 (see Figure 3-1) in 1993. However, the TCE concentration in this well has declined with time, and was detected at 380 µg/l in 2002. The maximum depth at which TCE has been detected on Base is 280 feet bgs at a concentration of 2.0 µg/l, near the northern distal end of the on-Base plume. The off-Base TCE plume is split into two portions: an eastern and a western leg. Off-Base TCE concentrations are highest in the Ridgeview Estates area immediately south of the OU 8 IRA Hydraulic Containment System, and in the distal portions of both legs of the off-Base contaminant plume. The highest off-Base TCE concentration reported was 465 µg/l in the area immediately south of the IRA Hydraulic Containment System. Chemical partitioning calculations estimate the total mass of TCE within the OU 8 plume to be approximately

9,800 pounds, with approximately 3,600 pounds in the aqueous phase (i.e., dissolved). The estimated volume of groundwater contaminated with TCE at OU 8 is approximately 5.9 billion gallons.

3.2.0.3. The western lobe of the OU 8 plume exhibits high concentrations of 1,2-DCA at the southern Base boundary and near the southern distal end of the TCE plume. The highest 1,2-DCA concentration detected in the off-Base portion of this plume was 697 µg/l, reported in monitoring well U8-096 (screened from 66 to 76 feet bgs), located just west of I-15 (see Figure 3-1). At the southern Base boundary, 1,2-DCA has been detected at more than 500 µg/l in monitoring well U8-024 (screened from 130 to 140 feet bgs), based on 1997 groundwater sample data. However, concentrations in U8-024 have since declined to less than 200 µg/l based on 2002 sample data. The off-Base 1,2-DCA plume has advanced several thousand feet ahead of the off-Base TCE plume in the western portion of the contaminant plume. This is attributed to the lower retardation factor for 1,2-DCA relative to TCE, and not necessarily differences in timing of release. The maximum depth at which 1,2-DCA has been detected at OU 8 is 184 feet bgs in monitoring well U8-124 located southwest of I-15. The estimated total mass of 1,2-DCA within the OU 8 plume is approximately 3,800 pounds with approximately 3,100 pounds in the aqueous phase. The estimated volume of groundwater contaminated with 1,2-DCA at OU 8 is approximately 3.8 billion gallons.

3.2.0.4. Other organic contaminants of concern include 1,1,1-TCA, 1,1-DCE, chlorobenzene, and compounds benzene, toluene, ethylbenzene, and xylenes (BTEX). 1,1,1-TCA currently is and has been a major constituent used in industrial processes at Hill AFB. The use of 1,1,1-TCA in place of TCE at Hill AFB began in 1968. The highest concentrations of 1,1,1-TCA have been reported in groundwater samples from wells located in the vicinity of the IWTP Sludge Drying Beds, and around Buildings 220 and 225. These locations are suspected sources of 1,1,1-TCA. Figure 3-2 shows the historical range of 1,1,1-TCA concentrations where reported above its MCL of 200 µg/l.

3.2.0.5. Unlike 1,1,1-TCA, 1,1-DCE has not been used in industrial processes on Base, and its presence in OU 8 groundwater is likely due to the chemical reduction of both

1,1,1-TCA (main pathway) and TCE (minor pathway). Figure 3-3 shows the historical range of 1,1-DCE concentrations observed above its MCL of 7 µg/l. As shown in Figure 3-3, the distribution of 1,1-DCE is similar to that of 1,1,1-TCA, with the highest concentrations occurring near the IWTP Sludge Drying Beds, and around Buildings 220 and 225. Cholorobenzene has been reported in concentrations above its MCL (100 µg/l) in groundwater samples from monitoring wells in the vicinity of the IRA Hydraulic Containment System at the southern Base boundary. Based on reported occurrences and concentrations of chlorobenzene, the former Berman Pond is the suspected source of this contaminant. BTEX compounds have been reported in monitoring wells located in the vicinity of former UST sites 260 and 280. These sites were previously described in Section 2.0 and shown on Figure 2-1.

3.2.0.6. Inorganic contaminants that have been reported in OU 8 groundwater above their respective MCLs include antimony, arsenic, hexavalent chromium, cadmium, nickel, and lead in the vicinity of Building 225 and the IWTP. Table 3-2 presents the maximum historical concentrations of inorganic compounds that have been detected in OU 8 groundwater, and their respective MCLs where established. Figure 3-4 shows the historical distribution of metals where detected above MCLs. As shown on Figure 3-4, no discrete plumes are apparent. Antimony is the most widespread contaminant above MCLs in on-Base areas. However, it has been shown to be associated with filters used to prepare samples and therefore may not be a contaminant of concern. Arsenic was detected mostly in off-Base monitoring wells in areas outside of the VOC plume. Arsenic in groundwater is believed to be naturally occurring and controlled by geochemical conditions.

3.2.0.7. Hexavalent chromium contamination is very localized, and is detected only in on-Base areas. Hexavalent chromium was detected in groundwater samples collected from monitoring wells near Building 225. The highest concentration reported (3,200 µg/l) was from groundwater samples collected from monitoring well U7-009, which is located on the west side of Building 225 (see Figure 3-1). Hexavalent chromium concentrations have since declined, and the highest concentration reported in 2002 was 300 µg/l. Lead was detected only in on-Base monitoring wells located around the

Berman Pond, IRA, and the IWTP Sludge Drying Beds. Occurrences of nickel, cadmium, and total chromium are rather sporadic and lack any spatial continuity.

3.3 FATE AND TRANSPORT OF CONTAMINANTS

3.3.0.1. Contaminants have migrated from on-Base sources to other on-Base areas and to off-Base areas through the shallow aquifer. Figure 3-5 presents a conceptual model for fate and transport of contaminants at OU 8. Factors that have influenced off-Base contaminant migration and the spatial distribution of contaminants include stratigraphic controls, source locations, source age, contaminant characteristics, and changes in the piezometric surface through time. Preferential pathways caused by higher hydraulic conductivity materials likely control the shape and position of the plumes. Different source locations for TCE and 1,2-DCA also likely affect the distribution of contaminants. Changes to the piezometric surface likely occurred due to changes in operation of stormwater retention ponds. Infiltration beneath Pond 2 during its years of operation (1942 – 1974) as a storm water retention pond most likely caused groundwater mounding. This mounding altered hydraulic gradients in the vicinity of the pond, changing the natural southwesterly flow to a more southerly flow direction. Once Pond 2 was eliminated from the Hill AFB storm-water system in 1974, groundwater mounding beneath the pond likely dissipated with time and the local groundwater flow regime would have adopted the natural southwesterly flow direction. It is believed the east and west legs of the current off-Base plume configuration were the result of the hydraulic gradient changes associated with the history of Pond 2.

3.3.0.2. Detailed analysis of the off-Base hydraulic conductivity field during groundwater model development suggests that stratigraphic units with relatively high hydraulic conductivity may provide preferential pathways for contaminant migration. These units are more prevalent along the western portion of the off-Base plume and are primarily encountered in the deeper portion of the shallow aquifer. By contrast, the stratigraphy along the eastern portion of the off-Base aquifer indicates that the relatively higher conductivity units occur at shallower depths. The occurrence of 1,2-DCA primarily in the deeper portion of the western off-Base plume is consistent with the depth

at which 1,2-DCA is detected at the southern Base boundary, where concentrations above 400 µg/l have been reported at a depth of 140 feet bgs.

3.3.0.3. Off-Base contaminant migration is also affected by other natural stratigraphic controls. For example, a distinct change in stratigraphy from primarily silty sand with clay/silty clay interbeds to predominantly thick sequences of poorly graded sands in the area beneath I-15 appears to correlate with a drop in water table elevation in this area.

3.3.0.4. Chemical and geochemical data at OU 8 suggests that biodegradation of chlorinated solvents is occurring. There is evidence of reductive dehalogenation of TCE in the off-Base plume and on Base near the southern Base boundary. However, in some areas where biodegradation is evident, concentrations of TCE have not decreased significantly. In the industrial area on Base, TCE concentrations have declined significantly through time in the most contaminated wells. However, there is little evidence of reductive dehalogenation in this area; hence, the decline may be a result of other natural attenuation processes such as advection, dilution (by recharge), dispersion, and other degradation processes.

3.4 EXPOSURE POTENTIAL

3.4.0.1. The *Baseline Risk Assessment* examined risks to human health under both current and possible future conditions. Under current conditions, receptors that may be exposed to OU 8 constituents include:

- On-Base workers who could inhale constituents volatilizing from groundwater into offices and other places of work
- Off-Base residents who could inhale constituents volatilizing from groundwater into homes
- Construction workers who could come in contact with groundwater when it is quite shallow (less than 10 feet below the ground surface).

- Children who could come in contact with seep water while playing in the wooded area that constitutes Willow Bend.

3.4.0.2. Note that since the *Baseline Risk Assessment* was performed, the Willow Bend wetland area no longer exists, as it has been drained and backfilled to allow for residential construction. Therefore, the exposure pathway for this area no longer exists. In the future, changes in land use could change the pathways by which exposure could occur. The following additional pathways were evaluated in order to provide a conservative benchmark for risk information purposes:

- On-Base residents who could inhale constituents volatilizing from groundwater into homes

- On- and Off-Base residents using shallow groundwater as their source of tap water.

3.4.0.3. The results of the risk assessment were compared to the benchmarks of a hazard index of 1 and a cancer risk range of 1×10^{-4} to 1×10^{-6}. The results of these comparisons are shown in Table 4-1 and discussed further in Section 4.0 (Summary of Site Risks).

3.4.0.4. Current Risks. As shown in Table 4-1, under current conditions, risks are within or below the 1×10^{-4} to 1×10^{-6} potentially acceptable cancer risk range for all receptors. For on-Base workers in the vicinity of Berman Pond, the estimated cancer risk was at the lower end of this range, with a value of 3×10^{-6}. For a residential area between the Willow Bend and U8-042 area, a cancer risk of 3×10^{-6} was estimated for inhalation of indoor air. Cancer risks were less than 1×10^{-6} for all other scenarios, and the hazard index estimates also were less than 1 for all scenarios.

3.4.0.5. Future Risks. Under potential future conditions, the estimate of the cancer risk exceeded 1×10^{-4} and/or the hazard index exceeded 1 at virtually all of the areas evaluated. These risk estimates were primarily driven by the potential use of the shallow

groundwater as a source of drinking water. The low potential for this to actually occur must be considered in making risk management decisions for OU 8.

3.4.0.6. Ecological Risks. The potential for ecological risk due to the OU 8 contaminant plume was also evaluated in the risk assessment. Although OU 8 is concerned only with groundwater, it has the potential to impact several wetlands in the Layton area, where the groundwater comes to the surface.

3.4.0.7. Three wetland areas were identified where there was a potential for this impact. These include a small wetland in the Willow Bend subdivision (which is located immediately west of Northridge High School), a stormwater retention basin in the Woodland Park office complex, and a wetland in a currently undeveloped pasture east of I-15 and adjacent to the frontage road (see Figure 3-6). These areas were evaluated using an EPA approved screening-level ecological risk assessment protocol. Available data, consisting of surface water samples from the wetlands, and, where necessary, samples from nearby groundwater monitoring wells were compared to literature-based screening criteria. Site visits at each of the wetland areas were also conducted to record ecological resources, surrounding conditions, and potential future land use. Since this analysis was performed, the Willow Bend wetland area has been drained, and the area was backfilled during recent residential construction. As a result, the wetland area no longer exists.

3.4.0.8. None of the constituents that were detected in samples at any of the three wetlands exceeded the screening criteria. The two remaining wetlands are likely to be developed in the next three to five years. Based on these findings, it is unlikely that there is any potential for ecological risk to these areas or to the surrounding environment due to constituents associated with OU 8.

3.5 CURRENT AND POTENTIAL FUTURE LAND AND WATER USES

3.5.0.1. Current Land and Water Uses. Hill AFB is located in northern Davis County and extreme southern portion of Weber County. The on-Base portion of OU 8 is located in the southeastern quadrant of Hill AFB and is an industrial area that is used for servicing and maintaining aircraft. During the workday, the on-Base area near and

surrounding OU 8 contains a population of approximately 14,000 people, which includes transitory Hill AFB personnel who visit the area during the workday but are not formally assigned to this area. In the Layton Area of OU 8, land use varies from residential, commercial, and agricultural. This area has undergone rapid residential and commercial development over the last 10 years, and agricultural land use has declined. Three schools are present in the area: Lincoln Elementary, North Layton Junior High, and Northridge High School. In addition, Weber State University (WSU) is constructing a satellite campus in the OU 8 area. A hospital (Davis Medical Center) is located immediately west of I-15 in Layton.

3.5.0.2. Most of the agricultural areas surrounding Hill AFB are prime farmlands with minor unique farmlands near the Davis-Weber Canal. Unique farmlands are lands used for the production of specific high-value food/fiber crops.

3.5.0.3. The area south of Hill AFB has been subdivided according to 1999 aerial photography and land use. Crop production is primarily the cereal grains, wheat and barley, and alfalfa. Although there is some pastureland, very few livestock are raised on the pastures south of Hill AFB (Fowers, 1989).

3.5.0.4. Shallow groundwater is not currently used as a source of drinking water in the area. Five residents have or do use the shallow groundwater for irrigation or stock-watering purposes only (Montgomery Watson Harza, 2001). The Weber Basin Water Conservancy District supplies municipal water to the City of Layton. The district provides water from wells that tap deep aquifers that are unaffected by contaminants associated with OU 8. There are currently five known water supply wells located within or in close proximity to the OU 8 area of investigation. Groundwater from these wells is regularly monitored to ensure the integrity of the drinking water supply.

3.5.0.5. Potential Future Land and Water Uses. Hill AFB is expected to remain under the jurisdiction of the DOD for the foreseeable future. Future land use scenarios include land uses that may be appropriate if the Base were to be closed (e.g., industrial, residential).

3.5.0.6. The shallow groundwater in both on-Base and off-Base areas is not expected to be used as a potable water source in the future. While field drains exist that in the past were used for stock watering and irrigation, they are currently covered over and only used to dewater certain areas. The rapid conversion of farmland in the OU 8 area to commercial and residential development makes it highly unlikely that field drains will return to agricultural use in the future.

TABLE 3-1

MAXIMUM CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER OPERABLE UNIT 8 HILL AIR FORCE BASE, UTAH

Compound	Historical Maximum Concentration (µg/l)	Most Recent Maximum Concentration (µg/l)	Federal Primary Drinking Water MCL (µg/l)	State Drinking Water Quality Standard (µg/l)
1,1-Dichloroethane	42	32.7	NE	NE
1,1-Dichloroethene	200	33	7	7
1,1,1-Trichloroethane	1,200	160	200	200
1,1,2-Trichloroethane	2.5	0.8	5	5
1,2-Dichlorobenzene	110	43.3	NE	NE
1,2-Dichloroethane	697	360	5	5
1,2-Dichloroethene, total	93	NA	NE	NE
1,2-Dichloropropane	28	28	5	5
Benzene	2,500	267	5	5
Bromodichloromethane	7	7	NE	NE
Carbon tetrachloride	77	40.2	5	5
Chlorobenzene	6,000	550	100	NE
Chloroform	18	18	NE	NE
cis-1,2-Dichloroethene	180	180	70	70
Ethylbenzene	996	868	700	700
m,p-Xylenes	3,970	3,970	NE	NE
Methylene chloride	83	83	NE	NE
Naphthalene	168	168	NE	NE
o-Xylenes	1,780	1,780	NE	NE
Phenol	100	NA	NE	NE
Tetrachloroethene (PCE)	130	39	5	5
Toluene	2,500	448	1,000	1,000
trans-1,2-Dichloroethene	110	110	100	100
Trichlorofluoromethane	1.7	0.7	NE	NE
Trichloroethene (TCE)	2,000	680	5	5
Vinyl Chloride	15	13	2	2
Xylenes, Total	4,600	1,500	10,000	10,000

Bolded text indicates those VOCs that have been detected above MCLs in OU 8 groundwater

µg/l micrograms per liter
MCL Maximum Contaminant Level
NA Not analyzed
NE Not established
PCE Tetrachloroethene
TCE Trichloroethene
VOC volatile organic compound

TABLE 3-2

MAXIMUM CONCENTRATIONS OF
REGULATED INORGANIC COMPOUNDS IN GROUNDWATER
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Compound	Maximum Historical Concentration 1983-2002 (Filtered and Unfiltered) (µg/l)	Maximum Concentration 2000-2002 (Filtered) (µg/l)	Maximum Concentration 2000-2002 (Unfiltered) (µg/l)	Federal Drinking Water MCL (µg/l)	State Drinking Water Quality Standard (µg/l)
Antimony	150	39.5[(a)]	2	6	6
Arsenic	614	288	293	10	50
Barium	10,300	1,520	1,020	2,000	2,000
Beryllium	30	2.5	ND	4	4
Cadmium	270	57.7	1.4	5	5
Chromium, Total	6,660	388	1,040	100	100
Chromium, Hexavalent	3,200	NA	300	100	NE
Copper	1,170	NA	NA	1,300	1,000**
Fluoride	111,000	NA	1,800	4,000	4,000
Lead	3,330	35.3	6.8	15	NE
Mercury	2.1	1.3	0.94	2	2
Nickel	1,590	331	237	100	NE
Nitrate, Nitrogen	25,200	25,200	NA	10,000	10,000
Nitrite, Nitrogen	2,200	2,200	NA	1,000	NE
Silver	140	NA	NA	NE	100**
Sulfate	294,000	NA	194,400	250,000*	1,000,000
Thallium	5.7	NA	NA	2	2
Zinc	4,720	633	155	NE	5,000**

Bolded text indicates those compounds that have been detected above MCLs in OU 8 groundwater

(a) Detected concentration is anomalous in comparison to related time-series

* U.S. EPA National Secondary Drinking Water Regulation

** State of Utah Secondary Drinking Water Standard

µg/l micrograms per liter
MCL Maximum Contaminant Level
NA Not analyzed
ND Not detected
NE Not established
OU Operable Unit

FILE I:\hill_afb\dgn\ou8\8ROD3_05\3_01_8investloc305.dgn PLOT DATE/TIME 16-MAR-2005 16:40

EXPLANATION

- 1,2-DCA plume (2001–2003)
- City boundary
- Underground storage tank location
- Former pond site; presently filled and capped or not in use
- Groundwater monitoring well
- Extraction well
- Field drain sampling point
- Surface water sampling point
- Cone penetration test (CPT)
- Piezometer
- Transducer

TRICHLOROETHENE (TCE) CONCENTRATIONS IN GROUNDWATER (2001–2003)

- 5–10 ug/l
- 10–100 ug/l
- 100–1,000 ug/l

N

0 600 1200

Scale in Feet

OPERABLE UNIT 7
Building 220

ST50
Bldg. 204

Building
43

ST37
Bldg. 214

ST65
Bldg. 236

Building
272
(demolished)

ST63
Bldg. 837

ST64
Bldg. 228

OPERABLE UNIT 7
Building 225

Building 257

ST74
Bldg. 260

ST35
Bldg. 280

ST36
Bldg. 510

OPERABLE UNIT 3
RVMF
Buildings 511 and 514

OPERABLE UNIT 11
Building 454
(demolished)

OPERABLE UNIT 3
Sodium Hydroxide
Tank Site

OPERABLE UNIT 3
Industrial Wastewater
Treatment Plant (IWTP)
Sludge Drying Beds

Hill Air Force Base
Boundary

OPERABLE UNIT 9
Pond 3
Previously
Operable Unit 3

OPERABLE UNIT 3
Berman Pond

ST44
Bldg. 598

Pond 2

WEBER STATE
UNIVERSITY
BOUNDARY

OPERABLE UNIT 9
Pond 1
Previously
Operable Unit 3

IRA
CONTAINMENT
SYSTEM
(See Detail A)

Clearfield
High
School

CLEARFIELD

Northridge
High School

North Layton
Junior High School

Lincoln
Elementary

LAYTON
CITY

Layton Hills
Mall

Hill Field Road

Main Street

Davis - Weber Canal

15

DETAIL A

0 100 200 300

Scale in Feet

HILL AIR FORCE BASE
OPERABLE UNIT 8

INVESTIGATION LOCATION MAP WITH TCE AND 1,2-DCA PLUMES

FIGURE 3-1

FILE I:\hill_afb\dgn\ou8\8ROD3_05\3_02_8tca305.dgn PLOT DATE/TIME 16-MAR-2005 16:53

EXPLANATION

- Groundwater monitoring well
- Extraction well
- Field drain sampling point
- Surface water sampling point
- Cone penetration test (CPT)
- Piezometer
- Approximate 1,1,1-TCA plume area above MCL (200 ug/l)
- ND Not detected

LOCATION ID
CONTAMINANT CONCENTRATION

All concentrations reported in ug/l

N

0 1000

Scale in Feet

U7-012
1,1,1-TCA
140-289

U7-008
1,1,1-TCA
92-740

T-228-001
1,1,1-TCA
66-330

U7-011
1,1,1-TCA
16-200

U7-009
1,1,1-TCA
ND-220

U9-010
1,1,1-TCA
19-390

U3-011
1,1,1-TCA
ND-730

U3-025
1,1,1-TCA
170-1200

Hill Air Force Base Boundary

HILL AIR FORCE BASE
OPERABLE UNIT 8

HISTORICAL RANGE OF 1,1,1-TCA CONCENTRATIONS WHERE DETECTED ABOVE MCL

FIGURE 3-2

FILE I:\hill_afb\dgn\ou8\8ROD3_05\3_03_8dce305.dgn PLOT DATE/TIME 16-MAR-2005 16:54

EXPLANATION

- Groundwater monitoring well
- Extraction well
- Field drain sampling point
- Surface water sampling point
- Cone penetration test (CPT)
- Piezometer
- Approximate 1,1-DCE plume area above MCL (7 ug/l)
- ND Not detected

LOCATION ID
CONTAMINANT CONCENTRATION

All concentrations reported in ug/l

N

0 1000

Scale in Feet

U8-008
1,1-DCE
ND-42

U8-129
1,1-DCE
ND-12

U7-012
1,1-DCE
45-69

U7-011
1,1-DCE
ND-120

T-236-001
1,1-DCE
8.7-84.5

U7-007
1,1-DCE
ND-15

U7-009
1,1-DCE
ND-34

T-228-001
1,1-DCE
9.4-41

U7-008
1,1-DCE
17-62

U8-108
1,1-DCE
ND-15.6

U8-011
1,1-DCE
ND-21.7

WW-9
1,1-DCE
ND

U3-029R
U3-029A
1,1-DCE
ND-30

U8-017
1,1-DCE
ND-9.4

WW-13
1,1-DCE
ND-12

U9-010
1,1-DCE
ND-110

U8-019
1,1-DCE
ND-37

U3-011
1,1-DCE
ND-24

U8-024
1,1-DCE
ND-11

U3-025
1,1-DCE
20-200

Hill Air Force Base Boundary

U8-116
1,1-DCE
4.0-16

U8-042
1,1-DCE
3.2-36.4

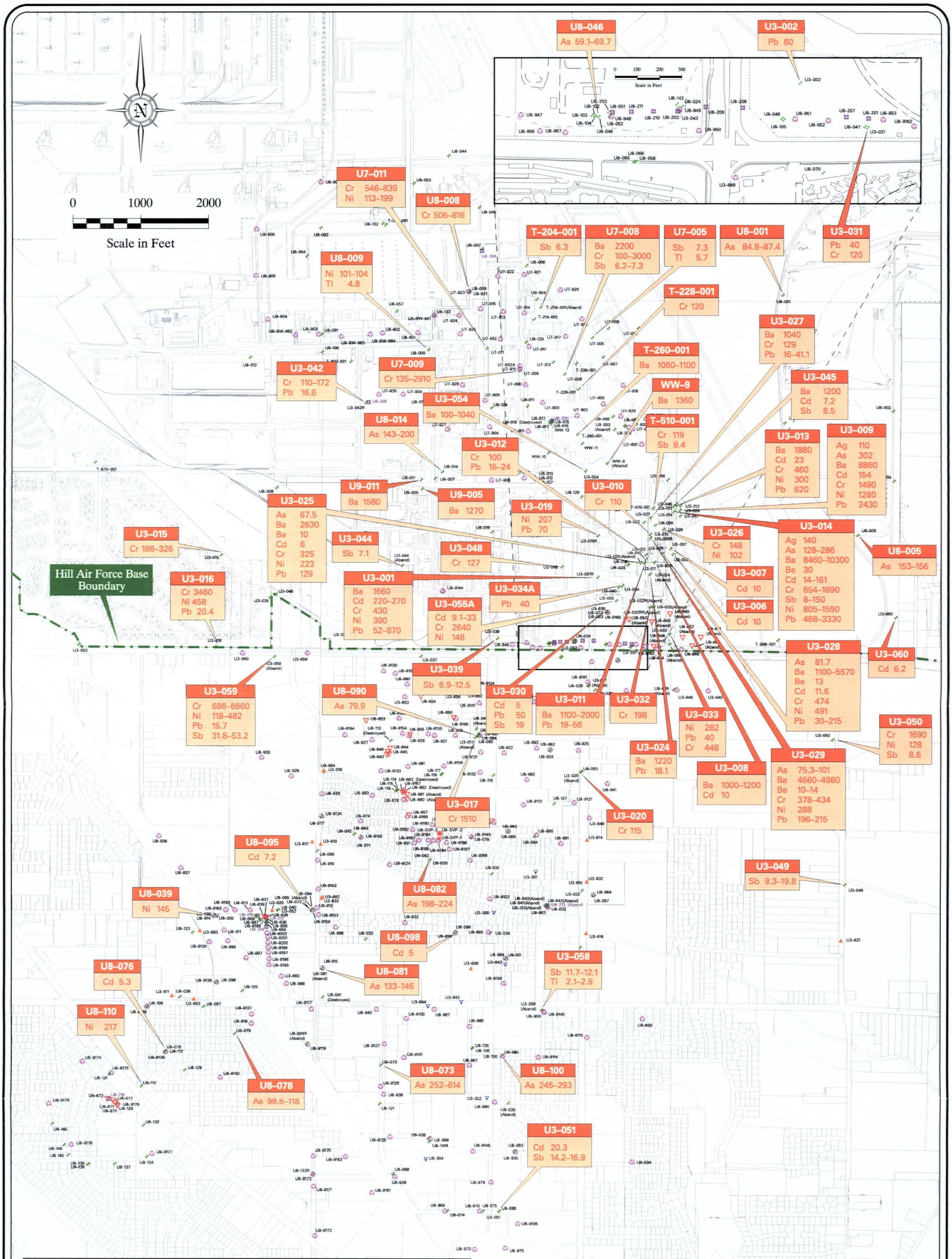
U8-063
1,1-DCE
5-15

HILL AIR FORCE BASE
OPERABLE UNIT 8

HISTORICAL RANGE OF 1,1-DCE CONCENTRATIONS WHERE DETECTED ABOVE MCL

FIGURE 3-3

FILE *I:\hill_afb\dgn\ou8\8ROD3_05\3_04_8metalROD305.dgn* PLOT DATE/TIME *16-MAR-2005 16:56*



EXPLANATION

- Groundwater monitoring well
- Extraction well
- Piezometer
- Field drain sampling point
- Surface water sampling point
- Cone penetration test (CPT)

All concentrations reported in ug/l
See Table 3–2 for MCL values for metals shown.

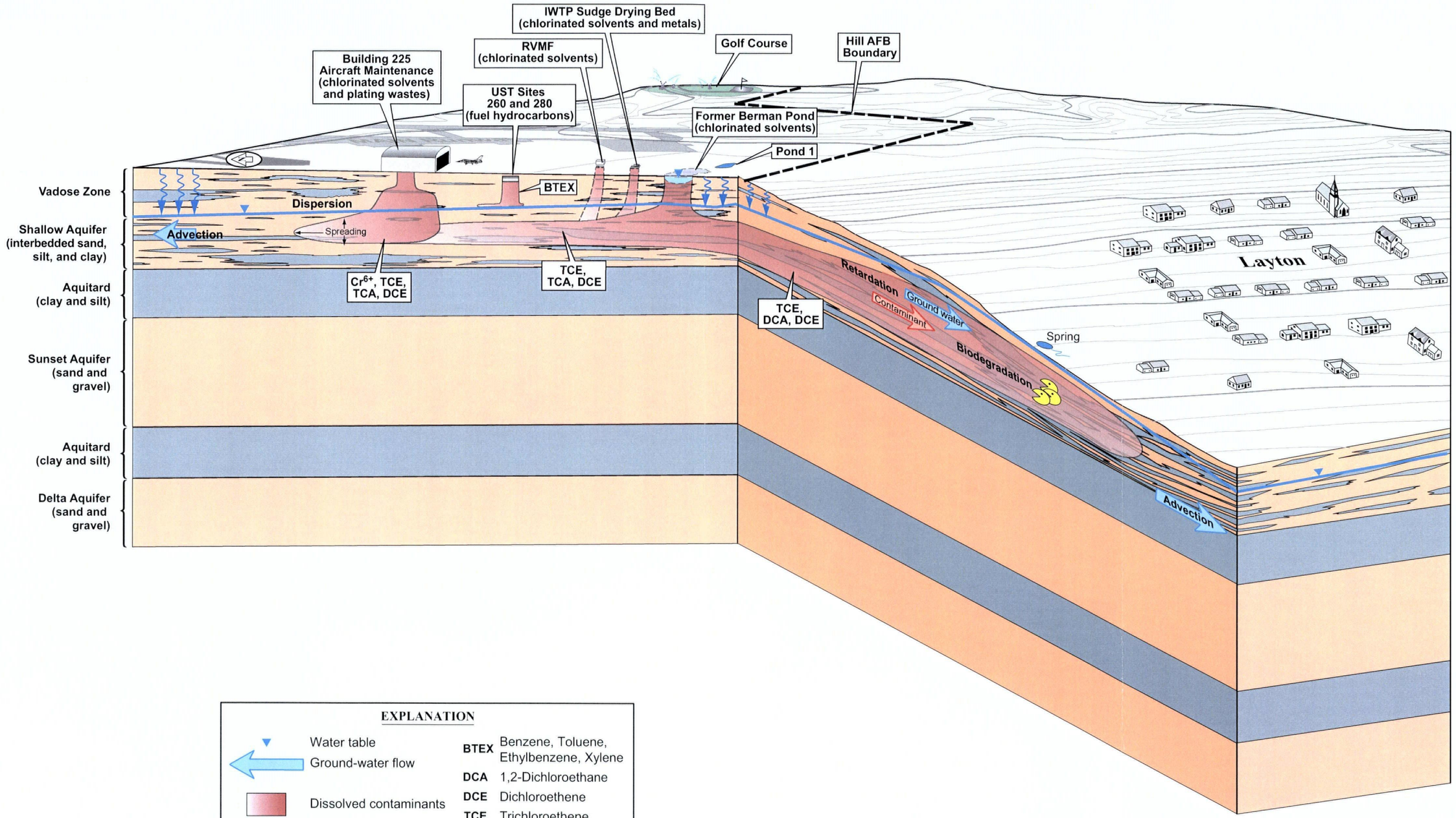
Sb	Antimony
As	Arsenic
Ba	Barium
Be	Beryllium
Cd	Cadmium
Cr	Chromium
Pb	Lead
Ni	Nickel
Tl	Thallium

75th AIR BASE WING

HILL AIR FORCE BASE
OPERABLE UNIT 8

HISTORICAL DISTRIBUTION OF METALS WHERE DETECTED ABOVE MCL

FIGURE 3–4



EXPLANATION

- Water table
- Ground-water flow
- Dissolved contaminants
- Recharge/infiltration

BTEX	Benzene, Toluene, Ethylbenzene, Xylene
DCA	1,2-Dichloroethane
DCE	Dichloroethene
TCE	Trichloroethene
TCA	1,1,1,-Trichloroethane
Cr^{6+}	Hexavalent Chromium

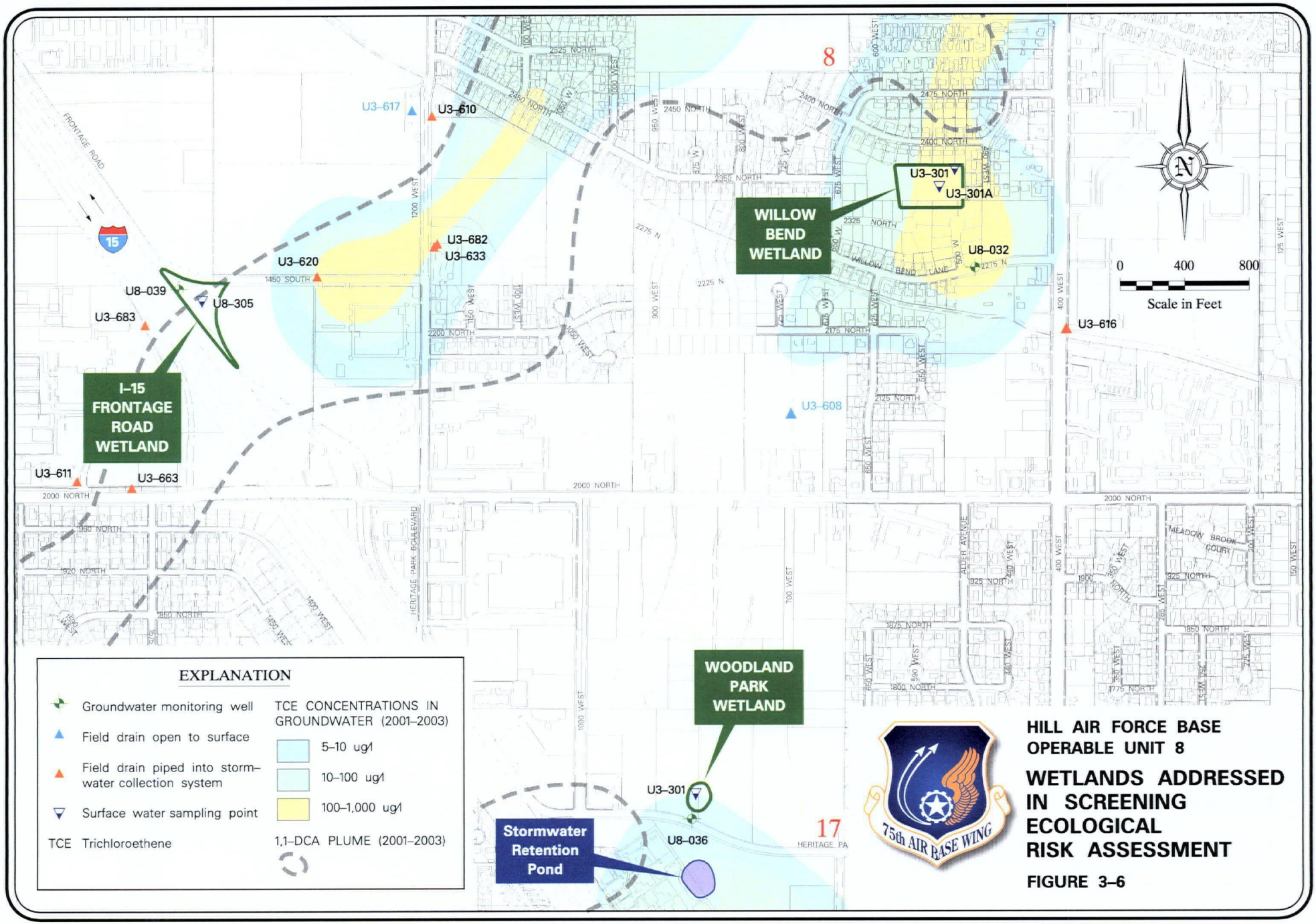
FILE 3_05_OU8 path_3-D_ROD305.ai 03/16/05

HILL AIR FORCE BASE
OPERABLE UNIT 8

CONCEPTUAL MODEL FOR FATE AND TRANSPORT OF CONTAMINANTS ASSOCIATED WITH THE MAJOR OU 8 SOURCE AREAS

FIGURE 3-5

FILE I:\hill_afb\dgn\ou8\8ROD3_05\3_06_8ecoROD305.dgn PLOT DATE/TIME 16-MAR-2005 16:58



EXPLANATION

- Groundwater monitoring well
- Field drain open to surface
- Field drain piped into storm-water collection system
- Surface water sampling point
- TCE Trichloroethene

TCE CONCENTRATIONS IN GROUNDWATER (2001-2003)

- 5-10 ug/l
- 10-100 ug/l
- 100-1,000 ug/l

1,1-DCA PLUME (2001-2003)

75th AIR BASE WING

HILL AIR FORCE BASE
OPERABLE UNIT 8

WETLANDS ADDRESSED IN SCREENING ECOLOGICAL RISK ASSESSMENT

FIGURE 3-6

Section 4

Summary of Site Risks

4.0 SUMMARY OF SITE RISKS

4.1 INTRODUCTION

4.1.0.1. A *Baseline Risk Assessment* was prepared as part of, and included in, the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001). The Baseline Risk Assessment evaluated potential health and environmental effects caused by contamination at OU 8 under current and hypothetical future conditions. The risk assessment identifies the principal chemicals of concern (COC), current and future exposure pathways for humans and environmental receptors, and the probability of adverse effects resulting from exposure. This section of the ROD summarizes the results of the baseline risk assessment for this site.

4.2 HUMAN HEALTH RISK ASSESSMENT

4.2.1 Identification of Chemicals of Concern

4.2.1.1. The identification of chemicals of concern is typically performed to reduce the number of constituents to a manageable number, including all the constituents that account for most of the potential risks. For OU 8, all data of acceptable quality from the RI were used in the *Baseline Risk Assessment* to evaluate potential health risks. All constituents were carried forth into the quantitative portion of the risk assessment with the exception of essential nutrients (e.g., calcium, iron, manganese, potassium, and sodium) and constituents determined to be related to background conditions (e.g., arsenic). Details of the data selection and evaluation process are provided in the *Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001).

4.2.2 Exposure Assessment

4.2.2.1. The exposure assessment identifies the people who could come in contact with OU 8 constituents (known as receptors), describes the ways in which the contact could occur (known as exposure pathways), and reviews the assumptions used to calculate the amount of contact the receptors could have.

4.2.2.2. The *Baseline Risk Assessment* examined risks to human health under both current and possible future conditions. The exposure pathways evaluated in the *Baseline Risk Assessment* are shown in the *Conceptual Site Model of Exposure Pathways*, which is included as Figure 6-2 of that document. Under current conditions, the receptors evaluated in the *Baseline Risk Assessment* as having potential exposure to OU 8 constituents include:

- On-Base workers who could inhale constituents volatilizing from groundwater into offices and other places of work.

- Off-Base residents who could inhale constituents volatilizing from groundwater into homes.

- Construction workers who could come in contact with groundwater when it is quite shallow (less than 10 feet bgs).

- Children who could come in contact with seep water while playing in the wooded area that constitutes Willow Bend.

As previously mentioned the Willow Bend wetland area no longer exists, as it has been drained and backfilled to allow for residential construction. Therefore, the exposure pathway for this area no longer exists.

4.2.2.3. In the future, changes in land use could change the pathways by which exposure could occur. The following additional pathways were evaluated in order to provide conservative benchmarks for risk information purposes:

- Future on-Base residents who could inhale constituents volatilizing from groundwater into homes.

- On- and off-Base residents using shallow groundwater as their source of tap water.

4.2.2.4. The *Baseline Risk Assessment* generally used standard equations and assumptions available in EPA guidance to quantify chemical intake. Professional judgement was used to estimate exposure doses for children playing in the Willow Bend area. An EPA model was used to estimate indoor air concentrations, based on groundwater data. The *Baseline Risk Assessment* documents all the equations and assumptions used.

4.2.3 Toxicity Assessment

4.2.3.1. Chemicals may have carcinogenic (cancer-causing) effects as well as non-carcinogenic/systemic effects. Exposure to some of the chemicals detected at OU 8 could potentially result in both types of effects. For carcinogens, it is assumed that any amount of exposure to a carcinogenic chemical poses a potential for generating a carcinogenic response in the exposed organism.

4.2.3.2. Non-carcinogenic or systemic effects include a variety of toxicological end points and may include effects on specific organs or systems, such as the kidney, liver, lungs, and others. Threshold levels generally exist for non-carcinogenic effects; i.e., a dose exceeding a certain level must be reached before health effects are observed. No adverse effects are assumed for doses below the threshold.

4.2.3.3. Cancer slope factors (SFs), are used to provide conservative (health protective) estimates of excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SFs, which are expressed in units of milligrams per kilogram per day $[(mg/kg\text{-}day)^{-1}]$ are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper bound estimate of the excess lifetime cancer risk associated with exposure at the intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimation of the actual cancer risk unlikely. SFs are derived from the results of human epidemiological studies or chronic animal bioassays.

4.2.3.4. Reference doses (RfD) are used in evaluating whether there is a potential for adverse health effects, other than cancer, from exposure to OU 8 constituents. RfDs,

which are expressed in units of mg/kg-day, are estimated threshold levels for daily exposure below which exposure is considered safe for humans, including sensitive individuals. Estimated intakes of constituents from environmental media (e.g., the amount of a constituent ingested from contaminated drinking water) can be compared with the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied. SFs and RfDs are specific to the route of exposure; for example, oral RfDs are used to evaluate the potential for non-carcinogenic effects through ingestion of a constituent.

4.2.4 Summary of Risk Characterization

4.2.4.1. Carcinogenic and non-carcinogenic risks were calculated for each of the exposure pathways for site constituents and compared with acceptable levels of risk. For each potentially carcinogenic constituent, the probability that an individual will develop cancer over a lifetime was estimated from projected intake levels and the cancer SF. Cancer risks are probabilities generally expressed in exponential form. An individual excess lifetime cancer risk of 1×10^{-6} indicates that an individual has a 1-in-1 million additional chance of developing cancer as a result of site-related exposure to a carcinogen. The cancer risks were calculated over a 70-year lifetime under exposure conditions specific to OU 8.

4.2.4.2. According to NCP, potentially acceptable risk levels span the range of one in a million (1×10^{-6}) to one in ten thousand (1×10^{-4}). Risks in excess of 1×10^{-4} require remediation. Cancer risks less than 1×10^{-6} are considered *de minimis* risks, and do not require further attention. Risks in between 1×10^{-4} and 1×10^{-6} may require attention, depending on the site-specific remediation criteria. The NCP considers 1×10^{-6} as the point of departure in establishing the acceptable level of risk for the site.

4.2.4.3. To characterize the potential non-carcinogenic effects of chemicals, comparisons were made between projected intakes of site constituents and RfDs. A hazard quotient (HQ), which is the ratio between exposure to a chemical and that chemical's toxicity value, was calculated for each constituent and exposure pathway. Chemical-specific HQs

were then summed for each constituent and each pathway of exposure to calculate the total hazard index (HI) for each exposure scenario.

4.2.4.4. The HI is not a statistical probability of a health effect occurring. If the exposure level exceeds the appropriate toxicity value (i.e., the HQ is greater than 1), there may be cause for concern. The Superfund site remediation goal for non-carcinogens is a total HI of less than 1. Table 4-1 summarizes the cancer risk and hazard index estimates for each potential exposure scenario.

4.2.4.5. Current Risks. As shown in Table 4-1, under current conditions, cancer risks are within or below the 1×10^{-4} to 1×10^{-6} potentially acceptable cancer risk range for all receptors. Cancer risk estimates were between 1×10^{-4} to 1×10^{-6} only for on-Base workers in the vicinity of Berman Pond and residents living in-between Willow Bend and the area around well U8-042. For both receptors, the estimated cancer risk was at the lower end of this range, with a value of 3×10^{-6}. Cancer risks were less than 1×10^{-6} for all other scenarios. The hazard index was estimated to be less than 1 for all scenarios.

4.2.4.6. Future Risks. Under potential future conditions, the estimate of the cancer risk exceeded 1×10^{-4} and/or the hazard index exceeded 1 at virtually all of the areas evaluated. These risk estimates were primarily driven by the potential use of the shallow ground water as a source of drinking water. The low potential for this to actually occur must be considered in making risk management decisions for OU 8.

4.3 ECOLOGICAL RISK CHARACTERIZATION

4.3.0.1. The potential for ecological risk due to the OU 8 contaminant plume was also evaluated in the *Baseline Risk Assessment.* Although OU 8 is concerned only with ground water, it has the potential to impact several wetlands in the Layton area, where the ground water comes to the surface.

4.3.0.2. Three wetland areas were identified where there was a potential for this impact: a small wetland in the Willow Bend subdivision, a stormwater retention basin in the Woodland Park office complex, and a wetland in a currently undeveloped pasture east of

I-15 and adjacent to the frontage road. These areas were evaluated using a screening-level ecological risk assessment protocol. Available data, consisting of surface water samples from the wetlands, and, where necessary, samples from nearby groundwater monitoring wells, were compared to literature-based screening criteria. Site visits at each of the three wetland areas were also conducted to record ecological resources, surrounding conditions, and potential future land use. Since this analysis was performed, the Willow Bend wetland area no longer exists, as it has been drained and backfilled to allow for residential construction.

4.3.0.3. Maximum detected constituent concentrations were compared to aquatic screening criteria (known as Preliminary Remediation Goals, or PRGs). The PRGs were to developed to be protective of both aquatic life (e.g., aquatic plants, benthic invertebrates, and fish), and terrestrial wildlife that feeds on aquatic life. None of the constituents that were detected in samples at any of the three wetlands exceeded the PRGs. Based on current area development patterns, the two remaining wetlands are likely to be developed in the next three to five years. Based on these findings, it is unlikely that there is any potential for ecological risk to these areas or to the surrounding environment due to constituents associated with OU 8.

4.4 UNCERTAINTY ANALYSIS

4.4.0.1. Uncertainties. The uncertainty associated with a risk estimate is primarily the combination of the uncertainties associated with the site characterization, toxicity evaluation, and exposure assessment. The site is considered to be well characterized, with a large number of environmental samples collected from a wide variety of locations over a long period of time. Estimates of exposure were generally based on EPA parameters that have been derived in a conservative manner; e.g., they are more likely to overestimate than underestimate exposure. There is also model uncertainty associated with estimating indoor air concentrations. Uncertainties associated with the toxicity assessment include extrapolations from high to low dose, extrapolations from animals to humans, and lack of some toxicity values. EPA's overall approach in deriving toxicity

values, as with exposure parameters, is to be conservative such that there is a greater potential to overestimate than underestimate risk.

4.4.0.2. Additional uncertainties relate to future land use. A primary uncertainty associated with OU 8 is whether the future exposure pathways (especially those involving residential exposure on Base and use of shallow groundwater for drinking water both on- and off-Base) will actually become complete in the future. If not, the actual cancer risks and hazard indices for these future exposure scenarios are zero. It should be noted that current EPA risk assessment guidance requires consideration of such pathways. Due to development of the Willow Bend area, exposure pathways for both human and ecological receptors are now incomplete. For the ecological risk assessment, development of the remaining two wetlands would also eliminate exposure pathways and potential risks for those areas. For those exposure scenarios which have been quantitatively evaluated, the risk assessment is expected to be conservative, and the actual risks are expected to be less than those calculated in the *Baseline Risk Assessment.*

4.5 OVERVIEW OF SITE RISKS

4.5.0.1. The response action selected in this ROD is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

4.5.0.2. Remedial action at OU 8 is warranted on the basis of potential future risks to human health and the environment (i.e., to prevent a significant risk to residents). Also, remedial action is generally warranted when MCLs are exceeded in groundwater. Potential domestic groundwater use associated with future hypothetical scenarios accounts for the majority of the risk by ingestion, inhalation, and dermal pathways.

TABLE 4-1

SUMMARY OF RISK ASSESSMENT RESULTS
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Receptor	Well	Hazard Index	Cancer Risk
Current Exposure Scenarios With a Hazard Index Greater Than 1 and/or a Cancer Risk Greater Than 1 x 10^{-4}			
None	--	--	--
Current Exposure Scenarios With a Hazard Index Less Than 1 and a Cancer Risk Between 1 x 10^{-4} and 1 x 10^{-6}			
On-Base Worker, Berman Pond Area	U3-025	0.0004	3 x 10^{-6}
Off-Base Resident, Area Between Willow Bend and U8-042	NA	0.08	3 x 10^{-6}
Current Exposure Scenarios With a Hazard Index Less Than 1 and a Cancer Risk Less Than 1 x 10^{-6}			
On-Base Worker, UST Sites	WW-9	0.1	8 x 10^{-7}
On-Base Worker, Building 225 Area	U7-009	0.00004	2 x 10^{-7}
On-Base Worker, IRA Area	U3-043	0.000001	8 x 10^{-9}
Construction Worker, Weber State University – Davis Campus Area	U3-018	0.0003	5 x 10^{-11}
Construction Worker, Vicinity of Davis-Weber Canal	U8-042	0.04	6 x 10^{-8}
Construction Worker, Area South of Davis Weber Canal	U3-052	0.02	3 x 10^{-8}
Off-Base Resident, U8-042 Area	NA	NC	3 x 10^{-7}
Off-Base Resident, Willow Bend Area	NA	0.002	6 x 10^{-7}
Recreational Visitor (Child), Willow Bend Area	U8-301, U8-301A	0.02	2 x 10^{-7}
Potential Future Exposure Scenarios With a Hazard Index Greater Than 1 and/or a Cancer Risk Greater Than 1 x 10^{-4}			
On-Base Resident	U8-205	5	9 x 10^{-5}
On-Base Resident, Building 225 Area	U7-009	4	2 x 10^{-4}
Off-Base Resident	U8-212	7	5 x 10^{-4}
Potential Future Exposure Scenarios With a Hazard Index Greater Than or Equal to 1 and a Cancer Risk Greater Than 1 x 10^{-6}			
On-Base Resident, IRA Area	U8-210	1	6 x 10^{-5}

NA Not applicable
NC Not calculated

Section 5

Description of Alternatives

5.0 DESCRIPTION OF ALTERNATIVES

5.0.0.1. This section provides a detailed description of each of the alternatives considered for remediation of OU 8 groundwater. The discussions are separated into on-Base and off-Base areas. Elements common to the on-Base and off-Base alternative descriptions are also summarized. The specific details of the remedial components are intended only to serve as representative examples to allow order-of-magnitude cost estimates. Other viable process options to achieve the same objectives may be evaluated during remedial design activities for OU 8. The monitoring programs developed for the alternatives represent preliminary monitoring designs that were developed in the FS for the purpose of defining an initial scope and estimating costs. The final design of the monitoring program, including the number and exact locations of monitoring wells, will be defined during remedial design.

5.0.0.2. This section also introduces the remedial action objectives (RAOs) and performance standards developed to address potential future risks to human health and the environment and to guide alternative development. The following subsections provide a brief description of the RAOs and performance standards developed to address potential future unacceptable risk to human health and the environment. Additional details regarding how the RAOs and the response action will address these risks are provided in Section 7.0 (The Selected Remedy).

5.0.0.3. Remediation Goals and Performance Standards. In an effort to protect human health and the environment, RAOs and preliminary remediation goals (PRGs) were established in the OU 8 FS to address potential future unacceptable risk scenarios.

5.0.0.4. The RAOs for remediation of on-Base groundwater are as follows:

- Prevent migration of on-Base groundwater with contamination above PRGs to off-Base areas

- Prevent human exposure to contaminated groundwater above concentrations corresponding to an excess cancer risk between 1×10^{-4} to 1×10^{-6} and a chronic health risk defined by a hazard quotient of 1.

5.0.0.5. The RAOs for remediation of off-Base groundwater are as follows:

- Prevent human exposure to contaminated groundwater above concentrations corresponding to an excess cancer risk between 1×10^{-4} and 1×10^{-6} and a chronic health risk defined by a hazard quotient of 1

- Protect uncontaminated groundwater for future use

- Reduce the mass of contaminants in shallow groundwater to PRGs within a reasonable timeframe.

5.0.0.6. To meet the RAOs defined above, quantitative PRGs were developed to define the extent of remedial action. In general, PRGs establish concentrations of contaminants of concern that will not pose an unacceptable risk to human health and the environment, and are developed considering the following:

- RAOs representing concentration levels corresponding to an excess cancer risk for current or likely future exposure scenarios between 1×10^{-4} and 1×10^{-6}, a chronic health risk defined by a hazard quotient of 1, and/or a significant ecological risk

- Chemical-specific applicable or relevant and appropriate requirements (ARARs) (including MCLs and non-zero MCLGs [maximum contaminant level goal] for potential sources of drinking water)

- Background occurrence of specific constituents

- Factors related to technical limitations, uncertainties, and other pertinent information.

5.0.0.7. Chemical-specific ARARs (along with potential location- and action-specific ARARs) are detailed in the FS. Chemical-specific ARARs are health- or risk-based numerical values or methodologies derived from cleanup standards, standards of control, and other substantive environmental statutes or regulations. If these values are deemed "applicable" or "relevant and appropriate," they became a key element in developing PRGs when applied to the site-specific conditions. For contaminants found in OU 8 groundwater, MCLs are considered the PRGs for achieving site RAOs. The PRGs for remediation of OU 8 are presented in Table 7-1.

5.1 COMMON ELEMENTS AND DISTINGUISHING FEATURES OF EACH ALTERNATIVE

5.1.0.1. Several specific remedial components are common to more than one on-Base and off-Base alternatives. These components include:

- Institutional Controls
- Groundwater monitoring
- Continued operation of the IRA Hydraulic Containment System
- Groundwater extraction and discharge at various locations within the plume

5.1.0.2. The following paragraphs provide greater detail concerning each of these components.

5.1.1 Institutional Controls

5.1.1.1. Institutional Controls (ICs) include such actions as State water rights and use restrictions and limits on the use of federal real property. In the case of OU 8, where groundwater is the only contaminated media being addressed, the objective of these controls is to prevent access or use of the ground water until cleanup levels are met. These restrictions will remain in place and be monitored for effectiveness until the

concentration of hazardous substances in groundwater are at such levels to allow for unrestricted use and exposure.

5.1.1.2. Institutional Controls for OU 8 will be implemented in both on and off-Base areas. The Air Force will notify EPA in advance of any changes to the internal procedures that would affect the ICs. On-Base measures include:

- Maintaining the requirements of AFI-32-7020, which prohibits any construction or other activity that will disturb contaminated groundwater or interfere with remedial action equipment and facilities unless the proposed activity receives the concurrence of the EPA and UDEQ.

- Hill AFB Environmental Management (EM) review of all construction proposals (Hill AFB's "332 process") to ensure the requirements of AFI-32-7020 are met.

- State water rights and well-drilling restrictions to prevent exposure to contaminated groundwater. Areas of OU 8 covered by these restrictions are shown in Figures 5-2 through 5-11 and are summarized in Figure 5-12. The Utah Division of Water Rights (UDWR) regulates appropriation and distribution of all water within the State of Utah, and has developed a groundwater management plan for the Weber Delta area, which includes Hill AFB. As per this plan, areas of groundwater contamination associated with OU 8 (and other Hill AFB OUs) are identified as restricted, and installation of wells in the shallow aquifer in this area is not permitted. Hill AFB will send a letter to UDWR annually requesting verification of continuing enforcement of these restrictions throughout the life of the remedy.

5.1.1.3. Off-Base measures include:

- State restrictions on the installation of new wells in the shallow aquifer. Hill AFB will request annual verification from the State Engineer that the restrictions are still in place and being enforced.

- Hill AFB will acquire and maintain property leases and easements for remediation systems and monitoring locations. The leases will be renewed as needed and will remain in effect throughout the life of the remedy.

5.1.1.4. The Air Force is responsible for implementing, monitoring, maintaining, reporting on, and enforcing the ICs where it is within their power. Where state agencies bear a significant enforcement role, such as controlling water rights and issuing drilling restrictions, the Air Force will maintain regular communication with the state agency and request appropriate notification of enforcement actions. If the Air Force determines that specific IC requirements are not being met, it is understood that the remedy may be reconsidered and that additional measures may be required to ensure the protection of human health and the environment. The Air Force shall maintain ultimate responsibility for remedy integrity.

5.1.1.5. The Air Force will make prompt (as soon as practicable but no longer than 10 days after the Air Force becomes aware of the breach) notifications to regulators of (a) any remedy deficiency or failure that presents or could immediately lead to actual risk to human health and the environment, (b) any activity that is inconsistent with the IC objectives or use restrictions, (c) any other action that may interfere with the effectiveness of ICs. Notification will also state any corrective actions taken or planned to address such deficiencies or failures. The Air Force will conduct annual IC monitoring and submit to the EPA and UDEQ an annual monitoring report summary, describing the status of the controls, identifying any deficiencies, and how they have been addressed. The annual monitoring reports will be used in preparation of the Five Year Review to evaluate the effectiveness of the remedy.

5.1.2 Groundwater Monitoring

5.1.2.1. As part of all on-Base or off-Base alternatives, groundwater monitoring will be conducted to track progress of each alternative with regard to achieving remedial action objectives and cleanup goals. For those alternatives where MNA is the key component of the remedial action, groundwater monitoring will include parameters normally used to verify/confirm natural attenuation. The groundwater monitoring program will be

developed during the remedial design phase and will be included in the Performance Standard Verification Plan (PSVP) for OU 8.

5.1.3 IRA Hydraulic Containment System

5.1.3.1. All on-Base alternatives include the continued operation of the IRA Hydraulic Containment System at the southern Base boundary to prevent further migration of contaminants from suspected on-Base source areas to off-Base areas. In addition, restoration timeframes for all off-Base alternatives assume the continued operation of the system. The IRA Hydraulic Containment System will continue to operate until all remedial action objectives are achieved. Performance of the IRA Hydraulic Containment System will be reviewed every five years relative to the performance objectives specified in the ROD. If it is determined that performance objectives are not being met, adjustments will be made to the system to ensure that it is operating "properly" and "successfully.

5.1.4 Groundwater Extraction and Discharge

5.1.4.1. Several on-Base and off-Base alternatives include installation and operation of groundwater extraction wells, and potential treatment or direct discharge to the sanitary sewer system. The precise locations, construction, and operational details of these wells will be determined during development of the remedial design. The general locations of these wells were obtained using a computer model, and were selected to maximize contaminant mass removal while preventing further plume migration and limiting the total volume of groundwater extracted and treated.

5.1.4.2. Once extracted, the groundwater would be either (1) treated by air stripping and discharged to the stormwater system; or (2) discharged directly (untreated) to the sanitary sewer for treatment at the local POTW. Hill AFB will notify and obtain a discharge permit from the local POTW prior to discharge. These groundwater extraction systems will be monitored and evaluated regularly to ensure that the remedial action objectives for site remediation are being achieved. Performance objectives and parameters for the selected remedy will be described in a PSVP. If it is determined that performance

objectives are not being met, adjustments will be made to the system to ensure compliance with performance objectives. These may include varying pumping rates to eliminate stagnation points or to encourage adsorbed contaminants to partition into groundwater, and/or installing additional extraction points to facilitate mass removal or containment.

5.2 DESCRIPTION OF ON-BASE REMEDIAL ALTERNATIVES

5.2.1 On-Base Alternative 1 – No Further Action

5.2.1.1. On-Base Alternative 1, essentially a no further action alternative, is intended to serve as a baseline for evaluation, as required by the NCP. Alternative 1 includes the following components:

- Groundwater monitoring
- Containment of contaminated groundwater at the Base boundary (through continued operation of the OU 8 IRA Hydraulic Containment System).

5.2.1.2. Institutional controls that are currently in place will not be renewed or updated under this alternative. Institutional controls are discussed further in Section 5.1.1. Figure 5-1 illustrates the components of On-Base Alternative 1. The groundwater monitoring program will be used to assess the degree of protection provided by the existing institutional controls and the IRA Hydraulic Containment System. Additionally, the groundwater monitoring program will track projected contaminant concentration declines over time.

5.2.1.3. The IRA Hydraulic Containment System will continue to operate as part of this alternative, thereby preventing further contaminant migration from suspected source areas on Base to off-Base areas.

5.2.2 On-Base Alternative 2 – Limited Action

5.2.2.1. On-Base Alternative 2 is similar to On-Base Alternative 1, except that Hill AFB would request the State Engineer to implement institutional controls to prohibit use of groundwater over the current and predicted future extent of the groundwater plume. This alternative includes the following components:

- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Groundwater monitoring
- Containment of contaminated groundwater at the Base boundary (through continuation of the OU 8 IRA Hydraulic Containment System).

5.2.2.2. Institutional controls consist of barriers such as regulatory and water rights restrictions, and limits on use of Air Force property that limit access to contaminated areas or use of contaminated groundwater. Institutional controls that are currently in place would be maintained under this alternative. Institutional controls are discussed further in Section 5.1.1. Figure 5-2 illustrates the components of On-Base Alternative 2. The groundwater monitoring program will be used to assess the degree of protection provided by the existing institutional controls and the IRA Hydraulic Containment System. Additionally, the groundwater monitoring program will track projected contaminant concentration declines over time.

5.2.3 On-Base Alternative 3 – Monitored Natural Attenuation

5.2.3.1. Monitored natural attenuation (MNA) pertains to the reliance on naturally occurring physical, chemical, and/or biological processes to achieve site-specific remedial objectives or cleanup goals within a time frame that is reasonable compared to other alternatives. Major components of Alternative 3 are shown in Figure 5-3. These components include:

- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater

- Groundwater monitoring

- Containment of contaminated groundwater at the Base boundary (through continuation of the OU 8 IRA Hydraulic Containment System)

- Monitoring of parameters to verify/confirm natural attenuation.

5.2.3.2. Institutional controls that are currently in place would be maintained under this alternative. Refer to Section 5.1.1 for detail regarding institutional controls. The groundwater monitoring program will be used to assess the degree of protection provided by the existing institutional controls and the IRA Hydraulic Containment System. Additionally, the groundwater monitoring program will track projected contaminant concentration declines over time, and will include additional parameters normally used to verify/confirm the occurrence of natural attenuation.

5.2.4 On-Base Alternative 4 – Pump and Treat Option 1

5.2.4.1. On-Base Alternative 4 consists of groundwater extraction and potential treatment prior to disposal. Major components of this alternative are shown in Figure 5-4 and include the following:

- Installation and operation of approximately 10 groundwater extraction wells to extract contaminated groundwater from localized high contaminant concentration areas on Base.

- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater

- Containment of contaminated groundwater at the Base boundary (through continuation of the OU 8 IRA Hydraulic Containment System)

- Groundwater monitoring.

5.2.4.2. The locations of the extraction wells were obtained through application of groundwater modeling using an optimization code. The objective of this alternative is to maximize contaminant mass removal while limiting the total volume of groundwater extracted and treated (i.e., achieve the lowest total flow rate with highest mass removal). Figure 5-4 shows the locations of the extraction wells for this alternative. Ten extraction wells pumping a combined total of approximately 100 gpm of groundwater at rates ranging from approximately 4 to 20 gpm would be installed within the plume, as shown in Figure 5-4. Once extracted, the groundwater would be either (1) treated with air stripping and discharged to the stormwater system; (2) discharged directly (untreated) to the sanitary sewer for treatment at the local publicly owned treatment works (POTW); or 3) discharged directly (untreated) to the storm sewer as long as concentrations remain below the acceptable discharge limits set by the Utah Division of Water Quality for Kays Creek of the Farmington Bay Drainage. As with the other on-Base alternatives, On-Base Alternative 4 also includes groundwater monitoring, continued implementation of institutional controls (see Section 5.1.1), and continued operation of the OU 8 IRA Hydraulic Containment System.

5.2.5 On-Base Alternative 5 – Pump and Treat Option 2

5.2.5.1. On-Base Alternative 5 is very similar to On-Base Alternative 4 and only differs in the number of groundwater extraction wells installed. Major components of this alternative are shown in Figure 5-5 and include the following:

- Installation and operation of approximately 19 groundwater extraction wells to maximize mass removal across the entire plume of contaminated groundwater on Base.

- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater

- Containment of contaminated groundwater at the Base boundary (through continuation of the OU 8 IRA Hydraulic Containment System)

- Groundwater monitoring.

5.2.5.2. The locations of the extraction wells were obtained through application of groundwater modeling using an optimization code. The objective of this alternative is to maximize contaminant mass removal while limiting the total volume of groundwater extracted and treated (i.e., achieve the lowest total flow rate with highest mass removal). Figure 5-5 shows the locations of the extraction wells for this alternative. The modeling predicted that 19 wells pumping at a combined rate of approximately 190 gpm would provide maximum mass removal. Once extracted, the groundwater would either be (1) treated with air stripping and discharged to the stormwater system; or (2) discharged (untreated) to the sanitary sewer and treated at the local POTW. As with the other on-Base alternatives, On-Base Alternative 5 also includes groundwater monitoring, continued implementation of institutional controls (see Section 5.1.1), and continued operation of the OU 8 IRA Hydraulic Containment System.

5.3 DESCRIPTION OF OFF-BASE REMEDIAL ALTERNATIVES

5.3.1 Off-Base Alternative 1 – No Action

5.3.1.1. Off-Base Alternative 1, essentially a no further action alternative, is intended to serve as a baseline for evaluation, as required by the NCP. Alternative 1 includes the following components:

- Groundwater monitoring

5.3.1.2. Institutional controls that are currently in place would not be renewed or updated under this alternative. Figure 5-6 illustrates the components of Off-Base Alternative 1.

The groundwater monitoring program will be used to assess the degree of protection provided by the existing institutional controls. Additionally, the groundwater monitoring program will track projected contaminant concentration declines over time.

5.3.2 Off-Base Alternative 2 – Limited Action

5.3.2.1. Off-Base Alternative 2 is similar to Off-Base Alternative 1, except that Hill AFB would request the State Engineer to implement institutional controls to prohibit use of groundwater over the current and predicted future extent of the groundwater plume. This alternative includes the following components:

- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Groundwater monitoring.

5.3.2.2. Institutional controls that are currently in place would be maintained under this alternative (see Section 5.1.1). Figure 5-7 illustrates the components of Off-Base Alternative 2. The groundwater monitoring program will be used to assess the degree of protection provided by the existing institutional controls. Additionally, the groundwater monitoring program will track projected contaminant concentration declines over time.

5.3.3 Off-Base Alternative 3 – Monitored Natural Attenuation

5.3.3.1. Major components of Off-Base Alternative 3 are shown in Figure 5-8. These components include:

- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Groundwater monitoring
- Monitoring of parameters to verify/confirm natural attenuation.

5.3.3.2. Institutional controls that are currently in place would be maintained under this alternative (see Section 5.1.1). The groundwater monitoring program will be used to assess the degree of protection provided by the existing institutional controls. Additionally, the groundwater monitoring program will track projected contaminant concentration declines over time, and will include additional parameters normally used to verify/confirm the occurrence of natural attenuation.

5.3.4 Off-Base Alternative 4 – Pump and Treat Option 1

5.3.4.1. Off-Base Alternative 4 consists of installation of a series of groundwater extraction wells in three locations to prevent further migration of high concentration contaminated groundwater. Major components of this alternative are shown in Figure 5-9 and include the following:

- Installation and operation of approximately 38 groundwater extraction wells to extract contaminated groundwater from localized high contaminant concentration areas on Base.

- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater

- Groundwater monitoring.

5.3.4.2. The extraction wells would be installed 1) near the leading edges of the two lobes of the off-Base TCE plumes, and 2) near the leading edge of the off-Base 1,2-DCA plume, as shown in Figure 5-9. Groundwater modeling results indicate that the following layout of extraction wells would be sufficient to contain contaminated groundwater:

- Western lobe of TCE – approximately 8 extraction wells, each pumping at approximately 7 gpm. Additional extraction wells may be necessary if future monitoring indicates that the plume drifts south-southeast as predicted by the model

- Western lobe of 1,2-DCA plume – approximately 10 extraction wells, each pumping at approximately 40 gpm. However, groundwater RAOs may be achieved with installation and operation of only 7 extraction wells in this area.

- Eastern lobe of TCE – approximately 20 extraction wells, each pumping at approximately 4 gpm.

5.3.4.3. Once extracted, the groundwater would be either (1) treated with air stripping and discharged to the storm sewer; (2) discharged directly (untreated) to the sanitary sewer for treatment at the local POTW; or 3) discharged directly (untreated) to the storm sewer as long as concentrations remain below the acceptable discharge limits set by the Utah Division of Water Quality for Kays Creek of the Farmington Bay Drainage. Additionally, this alternative includes the components from Off-Base Alternative 2, with the remaining portions of the plume allowed to naturally attenuate, including those plume areas beyond (downgradient of) the proposed extraction systems. As with Off-Base Alternative 2, Off-Base Alternative 4 also includes implementation of institutional controls (see Section 5.1.1) and groundwater monitoring.

5.3.5 Off-Base Alternative 5 – Pump and Treat Option 2

Off-Base Alternative 5 consists of some of the same components as in Off-Base Alternative 4. In this alternative, active extraction is only implemented along the western portion of the off-Base plume. Groundwater flow and contaminant transport modeling indicates that the smaller eastern portion of the plume migrates slowly and naturally attenuates to below its MCL within a short-time frame relative to the larger and more quickly migrating western 1,2-DCA plume. Therefore, Off-Base Alternative 5 consists of active extraction of the western plume only. Major components of this alternative are shown in Figure 5-10 and include the following:

- Installation and operation of approximately 18 extraction wells in two areas to extract contaminated groundwater

- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater

- Groundwater monitoring.

5.3.5.1. The extraction wells would be installed 1) near the leading edge of the western lobe of the TCE plume off-Base and, 2) on the leading edge of the western lobe of the 1,2-DCA plume, as shown in Figure 5-10. Groundwater modeling results indicate that the following layout of extraction wells would be sufficient to achieve RAOs for groundwater:

- Western lobe of TCE – approximately 8 extraction wells, each pumping at approximately 7 gpm. Additional extraction wells may be necessary if future monitoring indicates that the plume drifts south as predicted by the model

- Western lobe of 1,2-DCA plume – approximately 10 extraction wells, each pumping at approximately 40 gpm. However, groundwater RAOs may be achieved with installation and operation of only 7 extraction wells in this area.

5.3.5.2. Once extracted, the groundwater would be either (1) treated by air stripping and discharged to the stormwater system; (2) discharged directly (untreated) to the sanitary sewer for treatment at the local POTW; or 3) discharged directly (untreated) to the storm sewer as long as concentrations remain below the acceptable discharge limits set by the Utah Division of Water Quality for Kays Creek of the Farmington Bay Drainage. The remaining portions of the plume would be allowed to naturally attenuate, including those plume areas beyond (downgradient of) the proposed extraction systems. As with Off-Base Alternative 4, Off-Base Alternative 5 also includes implementation of institutional controls (see Section 5.1.1) and groundwater monitoring.

5.3.6 Off-Base Alternative 6 – Pump and Treat Option 3

5.3.6.1. Off-Base Alternative 6 consists of installation of numerous groundwater extraction wells to remediate the contaminated groundwater off Base. The extraction

wells would be installed along a series of transects across the two lobes of the off-Base plume. Major components of this alternative are shown in Figure 5-11 and include the following:

- Installation and operation of approximately 62 extraction wells in two areas to extract contaminated groundwater
- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Groundwater monitoring.

5.3.6.2. Groundwater modeling results suggest that approximately 62 extraction wells extracting groundwater at a combined rate of approximately 600-800 gpm would be sufficient to eventually remediate the off-Base plume without causing excessive drawdown. Once extracted, the groundwater would either be (1) treated with air stripping and discharged to a stormwater system; (2) discharged directly (untreated) to the sanitary sewer for treatment at the POTW; or 3) discharged directly (untreated) to the storm sewer as long as concentrations remain below the acceptable discharge limits set by the Utah Division of Water Quality for Kays Creek of the Farmington Bay Drainage. As with Off-Base Alternatives 2 through 5, Off-Base Alternative 6 also includes groundwater monitoring and continued implementation of institutional controls (see Section 5.1.1) until RAOs are achieved.

5.4 DISTINGUISHING FEATURES OF EACH ALTERNATIVE

5.4.0.1. This section presents distinguishing features of each alternative including key ARARs associated with each alternative, estimated time for design and construction, estimated time to reach RAOs, the estimated capital and O&M costs, and the expected outcome of each alternative. This information is summarized in Table 5-1 for on-Base alternatives and Table 5-2 for off-Base alternatives.

TABLE 5-1

DISTINGUISHING FEATURES OF ON-BASE ALTERNATIVES
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 1 of 2)

	Description	Key ARARs	Estimated time for design and construction	Estimated time to reach RAOs	Capital and O&M Costs	Long-Term Reliability of Remedy	Expected Outcome
On-Base Alternative 1	*No Further Action*	• UAC R315-101-3[a] • UAC R311-211[b] • 42 USC Sec 6901-6987;40 CFR Part 261[c]	*NA*	*30-plus years*	*Capital Costs = $0* *O&M Costs = $257,843*	*The plume is expected to remain within the Base boundaries*	*Localized areas of high concentrations will remain indefinitely in the vicinity of suspected source areas*
On-Base Alternative 2	*Limited Action*	• UAC R315-101-3[a] • UAC R311-211[b] • 42 USC Sec 6901-6987;40 CFR Part 261[c]	*NA*	*30-plus years*	*Capital Costs = $0* *O&M Costs = $257,843*	*The plume is expected to remain within the Base boundaries*	*Localized areas of high concentrations will remain indefinitely in the vicinity of suspected source areas*
On-Base Alternative 3	*Monitored Natural Attenuation*	• UAC R315-101-3[a] • UAC R311-211[b] • 42 USC Sec 6901-6987;40 CFR Part 261[c]	*NA*	*30-plus years*	*Capital Costs = $0* *O&M Costs = $310,715*	*The plume is expected to remain within the Base boundaries*	*Localized areas of high concentrations will remain indefinitely in the vicinity of suspected source areas*

TABLE 5-1

DISTINGUISHING FEATURES OF ON-BASE ALTERNATIVES
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 2 of 2)

	Description	Key ARARs	Estimated time for design and construction	Estimated time to reach RAOs	Capital and O&M Costs	Long-Term Reliability of Remedy	Expected Outcome
On-Base Alternative 4	*Pump and Treat Option 1*	• UAC R315-101-3[(a)] • UAC R311-211[(b)] • 42 USC Sec 6901-6987;40 CFR Part 261 [(c)]	*Approximately 12 months*	*30-plus years*	*Capital Costs = $1,420,000* *O&M Costs = $502,434*	*Groundwater extraction will speed contaminant removal. The plume is expected to remain within Base boundaries*	*Localized areas of high concentrations will remain indefinitely in the vicinity of suspected source areas*
On-Base Alternative 5	*Pump and Treat Option 2*	• UAC R315-101-3[(a)] • UAC R311-211[(b)] • 42 USC Sec 6901-6987;40 CFR Part 261 [(c)]	*Approximately 18 months*	*30-plus years*	*Capital Costs = $2,250,000* *O&M Costs = $679,303*	*Groundwater extraction will speed contaminant removal. The plume is expected to remain within Base boundaries*	*Localized areas of high concentrations will remain indefinitely in the vicinity of suspected source areas*

Reference:
(a) Utah Cleanup and Risk-Based Closure Standards
(b) Utah Corrective Action Cleanup Standards
(c) Federal Safe Drinking Water Act

TABLE 5-2

DISTINGUISHING FEATURES OF OFF-BASE ALTERNATIVES
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 1 of 2)

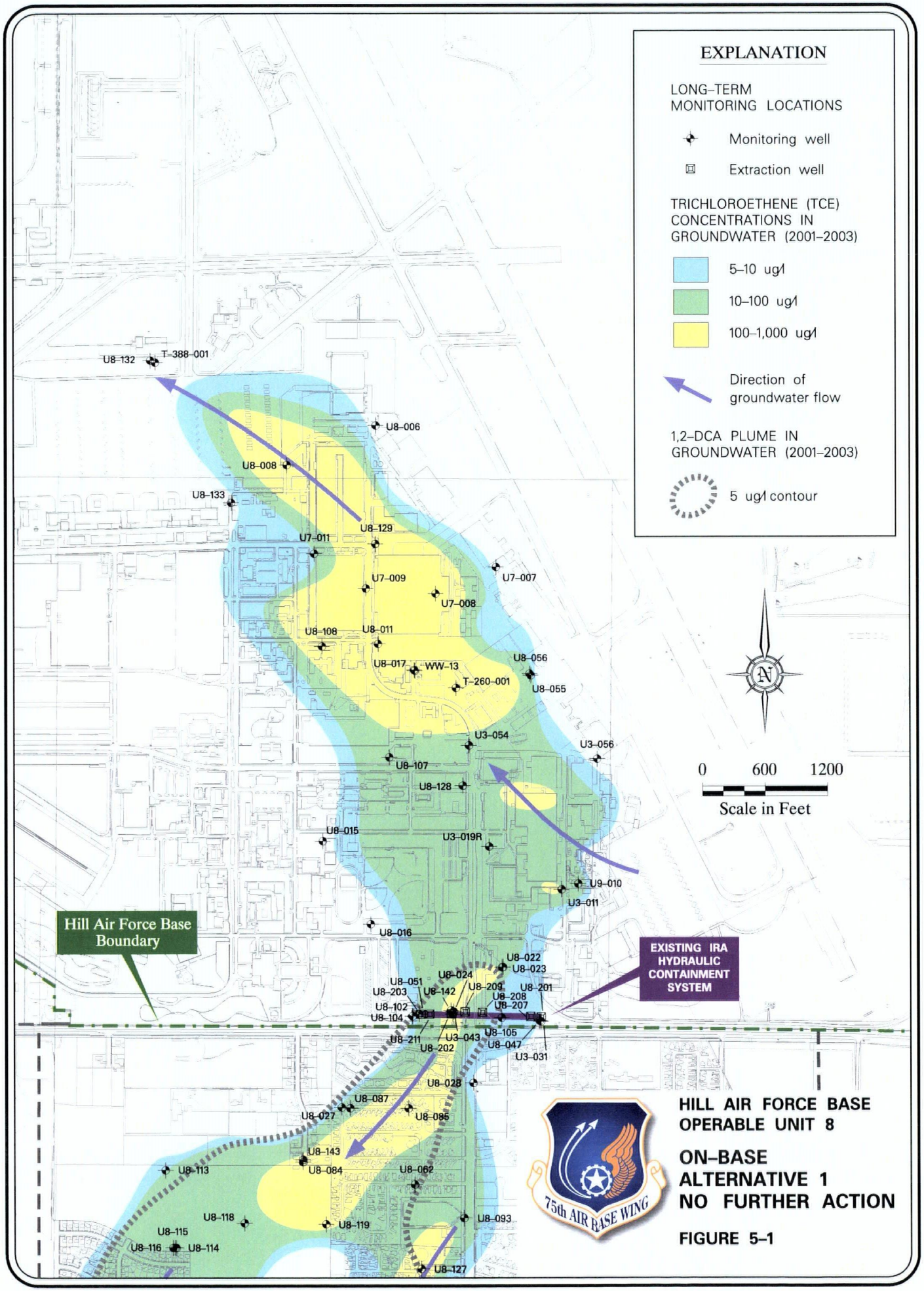
	Description	Key ARARs	Estimated time for design and construction	Estimated time to reach RAOs	Capital and O&M Costs	Long-Term Reliability of Remedy	Expected Outcome
Off-Base Alternative 1	*No Action*	• UAC R315-101-3[a] • UAC R311-211[b] • 42 USC Sec 6901-6987;40 CFR Part 261 [c]	*NA*	*150 years*	*Capital Costs = $0* *O&M Costs = $113,512*	*TCE plume will naturally attenuate; however, 1,2-DCA plume will continue to migrate*	*Cleanup will not be achieved within a reasonable timeframe*
Off-Base Alternative 2	*Limited Action*	• UAC R315-101-3[a] • UAC R311-211[b] • 42 USC Sec 6901-6987;40 CFR Part 261 [c]	*NA*	*150 years*	*Capital Costs = $0* *O&M Costs = $113,512*	*TCE plume will naturally attenuate; however, 1,2-DCA plume will continue to migrate*	*Cleanup will not be achieved within a reasonable timeframe*
Off-Base Alternative 3	*Monitored Natural Attenuation*	• UAC R315-101-3[a] • UAC R311-211[b] • 42 USC Sec 6901-6987;40 CFR Part 261 [c]	*NA*	*150 years*	*Capital Costs = $0* *O&M Costs = $168,450*	*TCE plume will naturally attenuate; however, 1,2-DCA plume will continue to migrate*	*Cleanup will not be achieved within a reasonable timeframe*
Off-Base Alternative 4	*Pump and Treat Option 1*	• UAC R315-101-3[a] • UAC R311-211[b] • 42 USC Sec 6901-6987;40 CFR Part 261 [c]	*12 to 18 months*	*65 years*	*Capital Costs = $3,750,000* *O&M Costs = $688,000*	*Groundwater extraction will speed contaminant removal*	*Cleanup may be achieved within a reasonable timeframe of 65 years*

TABLE 5-2

DISTINGUISHING FEATURES OF OFF-BASE ALTERNATIVES
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 2 of 2)

	Description	Key ARARs	Estimated time for design and construction	Estimated time to reach RAOs	Capital and O&M Costs	Long-Term Reliability of Remedy	Expected Outcome
Off-Base Alternative 5	*Pump and Treat Option 2*	• UAC R315-101-3[(a)] • UAC R311-211[(b)] • 42 USC Sec 6901-6987;40 CFR Part 261 [(c)]	*9 to 12 months*	*65 years*	*Capital Costs = $2,332,000* *O&M Costs = $434,000*	*Groundwater extraction will speed contaminant removal*	*Cleanup may be achieved within a reasonable timeframe of 65 years*
Off-Base Alternative 6	*Pump and Treat Option 3*	• UAC R315-101-3[(a)] • UAC R311-211[(b)] • 42 USC Sec 6901-6987;40 CFR Part 261 [(c)]	*18 to 24 months*	*60 years*	*Capital Costs = $5,540,000* *O&M Costs = $877,000*	*Groundwater extraction will speed contaminant removal*	*Cleanup may be achieved within a reasonable timeframe of 60 years*

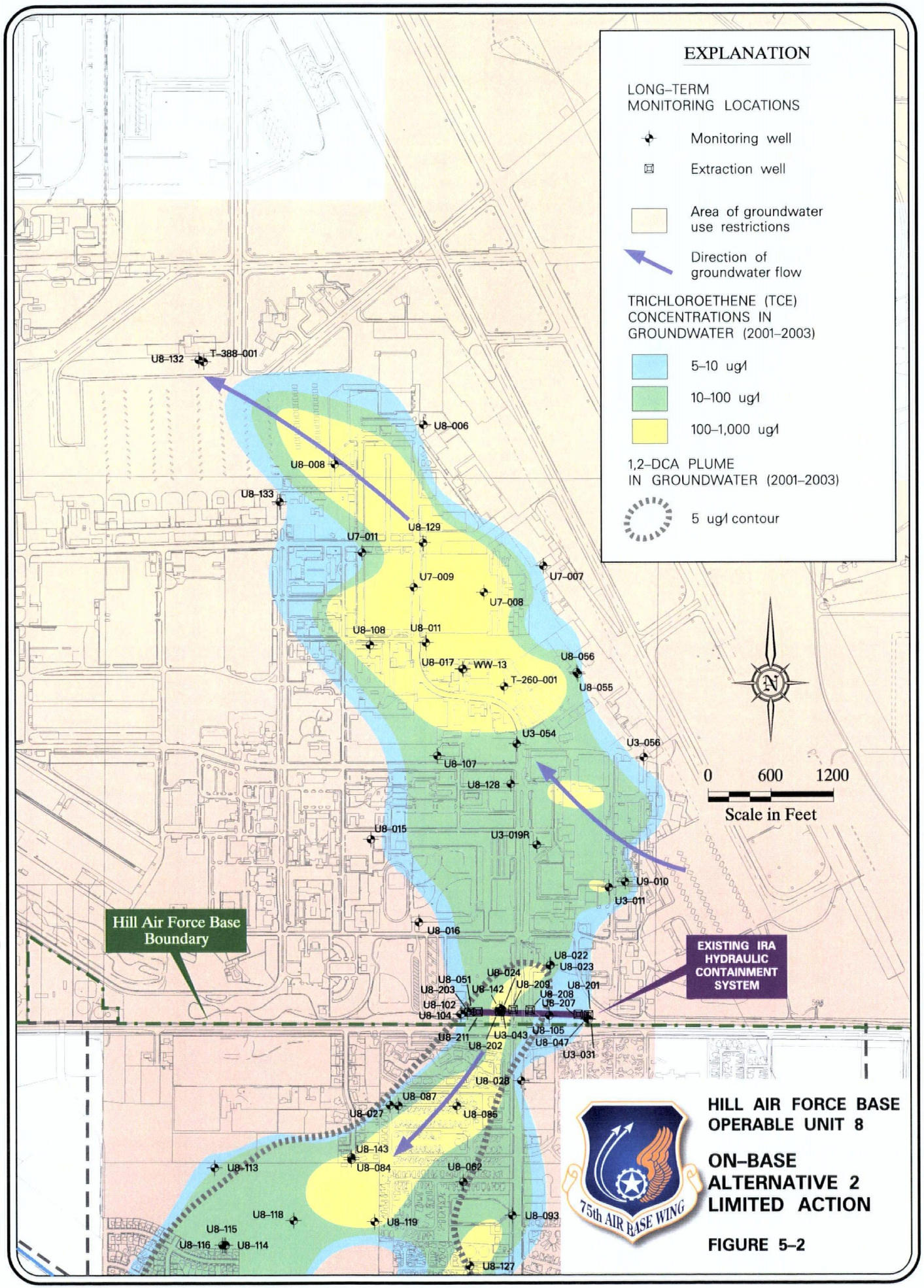
Reference:
(a) Utah Cleanup and Risk-Based Closure Standards
(b) Utah Corrective Action Cleanup Standards
(c) Federal Safe Drinking Water Act



PLOT DATE/TIME 16-MAR-2005 17:03

I:\hill_afb\dgn\ou8\8ROD3_05\5_01on1_ROD305.dgn

FILE



HILL AIR FORCE BASE
OPERABLE UNIT 8

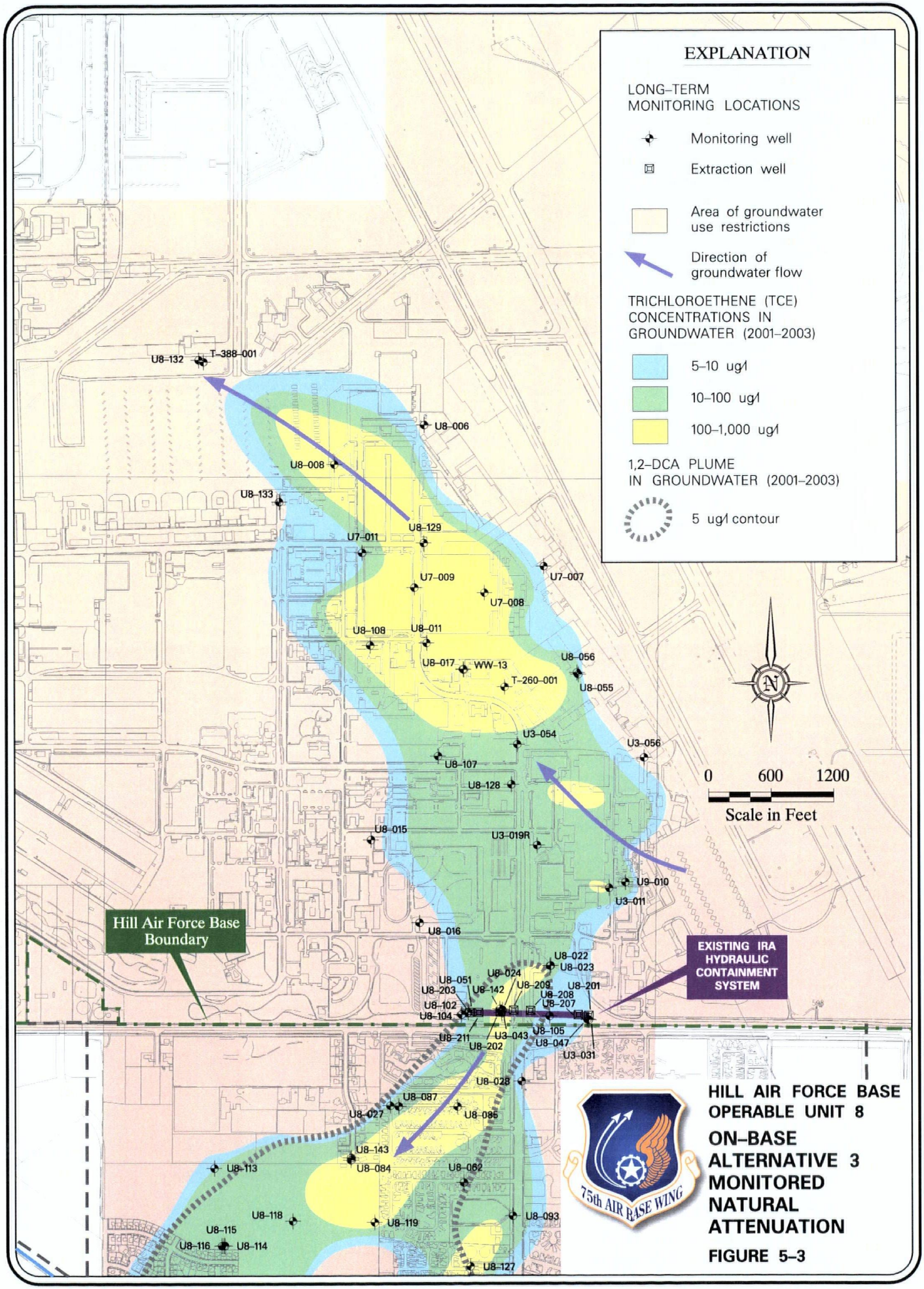
ON–BASE
ALTERNATIVE 2
LIMITED ACTION

FIGURE 5–2

PLOT DATE/TIME 16–MAR–2005 17:05

I:\hill_afb\dgn\ou8\8ROD3_05\5_02on2_ROD305.dgn

FILE



HILL AIR FORCE BASE
OPERABLE UNIT 8

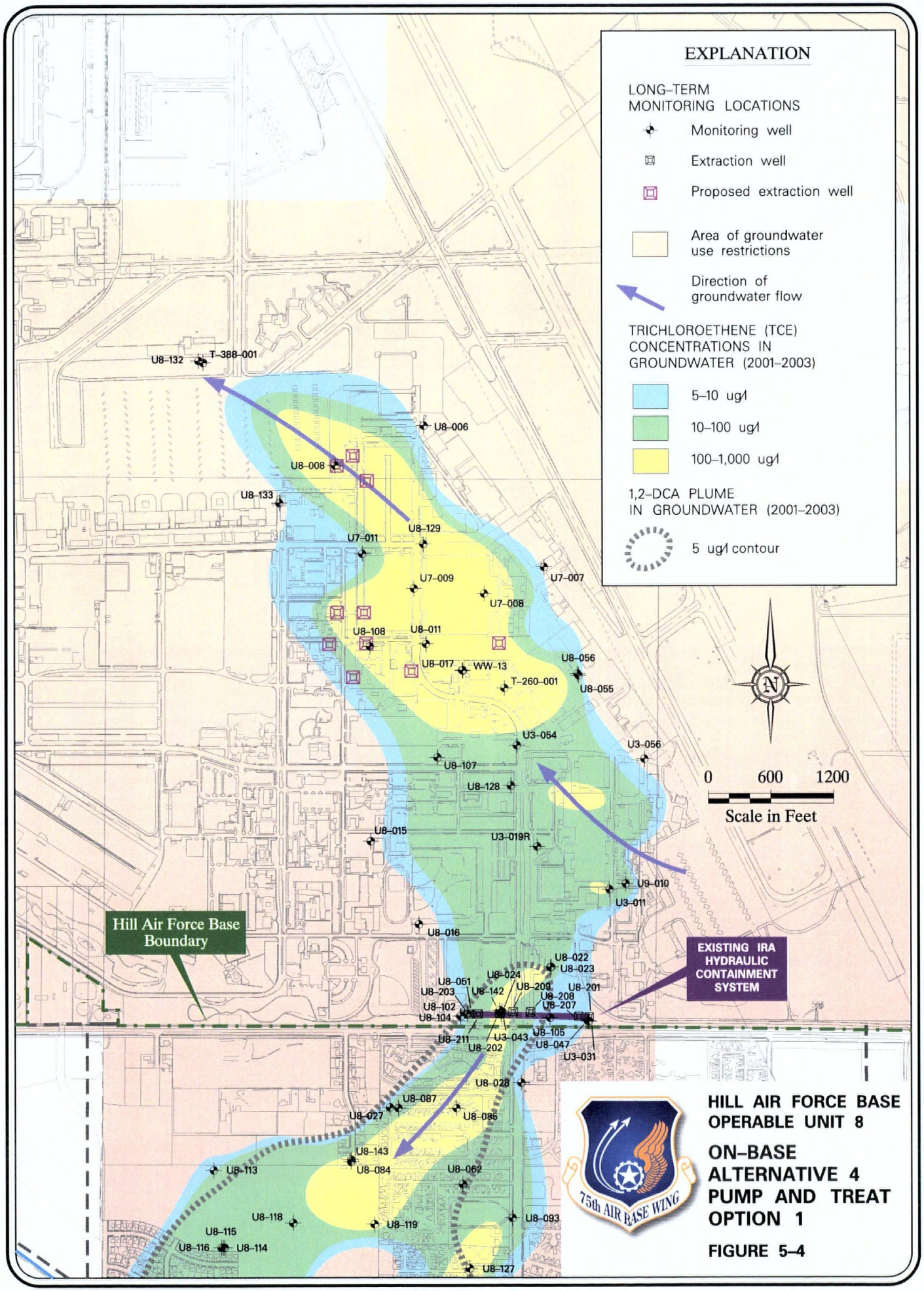
ON–BASE ALTERNATIVE 3 MONITORED NATURAL ATTENUATION

FIGURE 5–3

PLOT DATE/TIME 16-MAR-2005 17:06

I:\hill_afb\dgn\ou8\8ROD3_05\5_03on3_ROD305.dgn

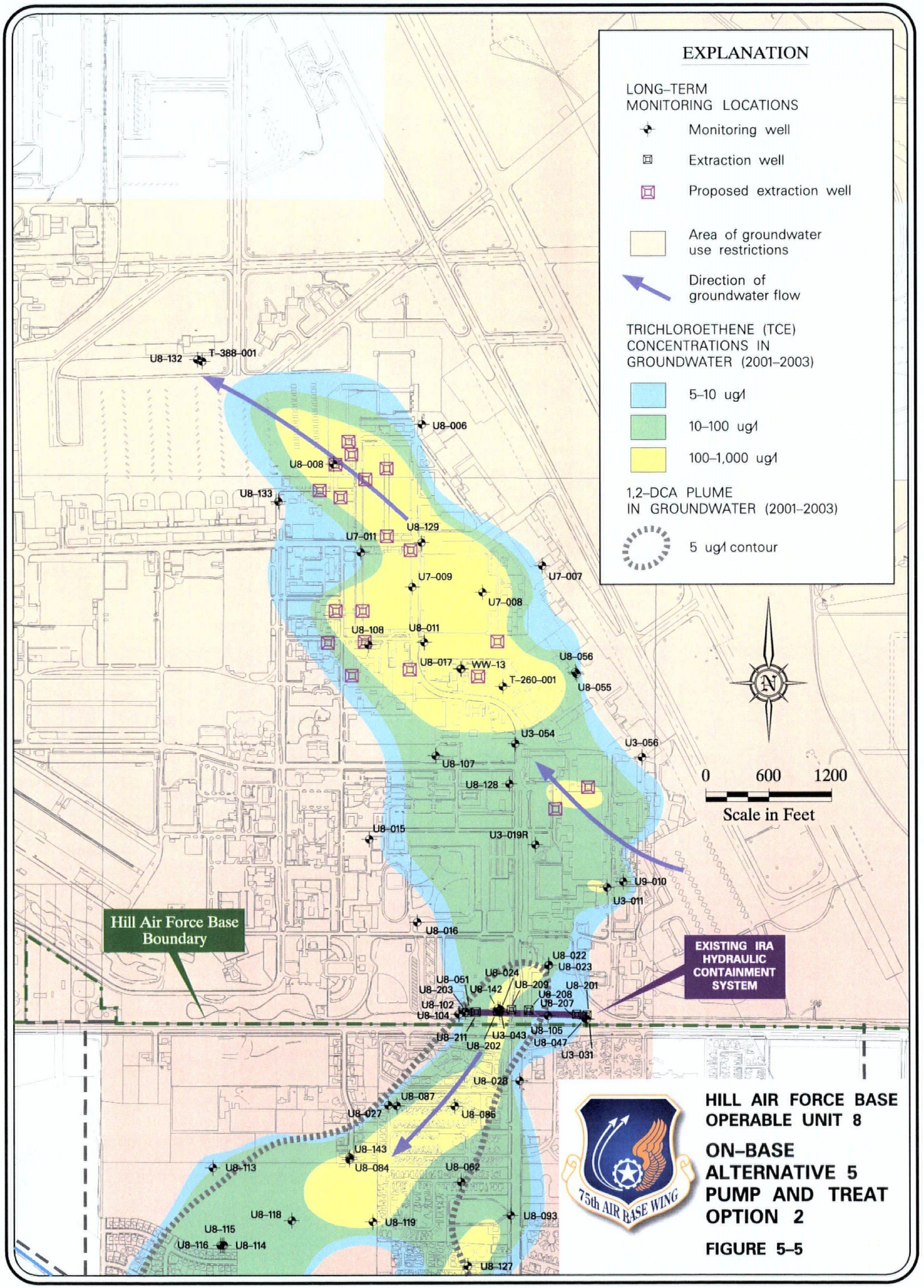
FILE



PLOT DATE/TIME 16-MAR-2005 17:08

I:\hill_afb\dgn\ou8\8ROD3_05\5_04on4_ROD305.dgn

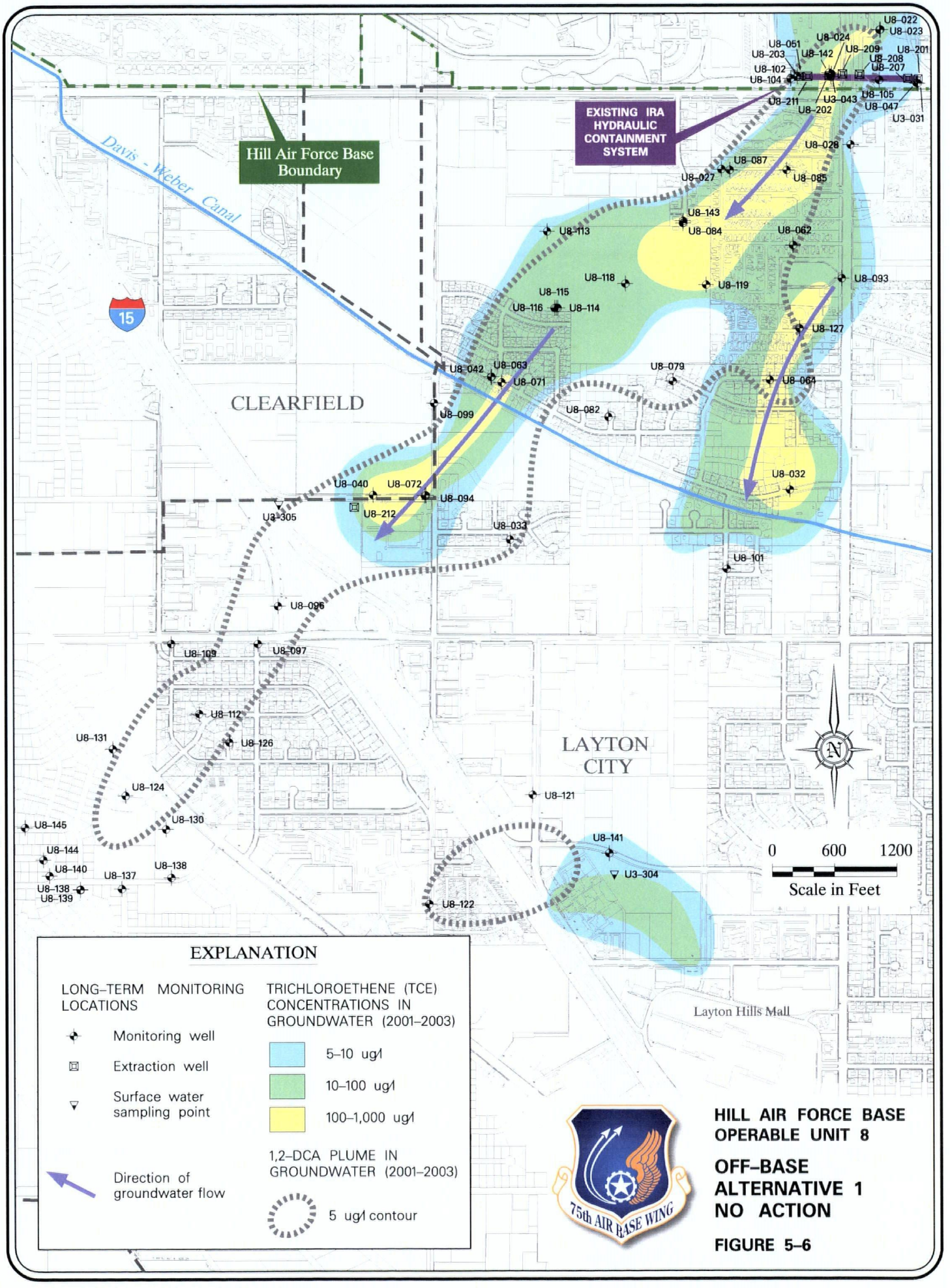
FILE



PLOT DATE/TIME 16-MAR-2005 17:10

I:\hill_afb\dgn\ou8\8ROD3_05\5_05on5_ROD305.dgn

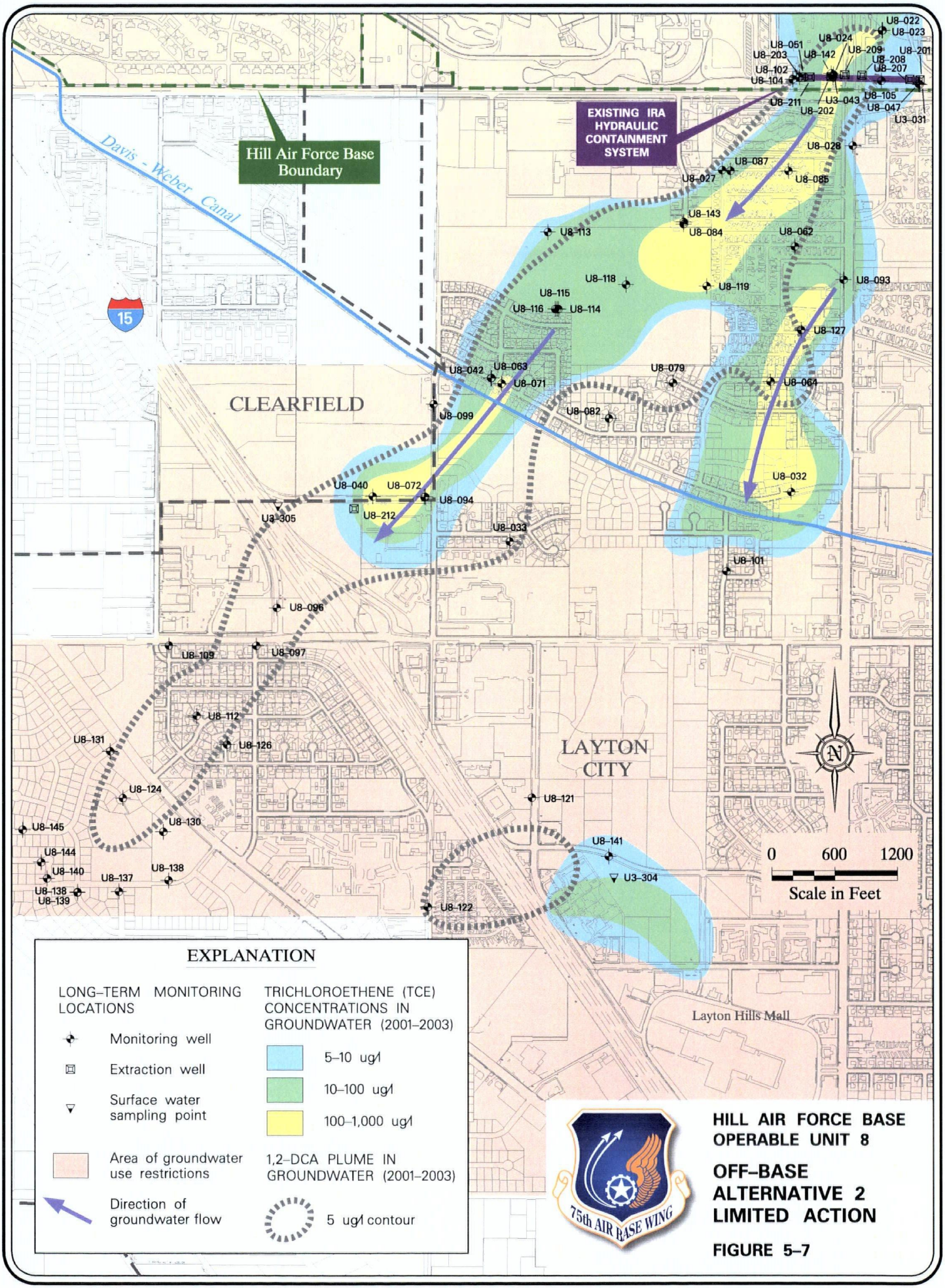
FILE



PLOT DATE/TIME 16-MAR-2005 17:24

I:\hill_afb\dgn\ou8\8ROD3_05\5_06offROD305.dgn

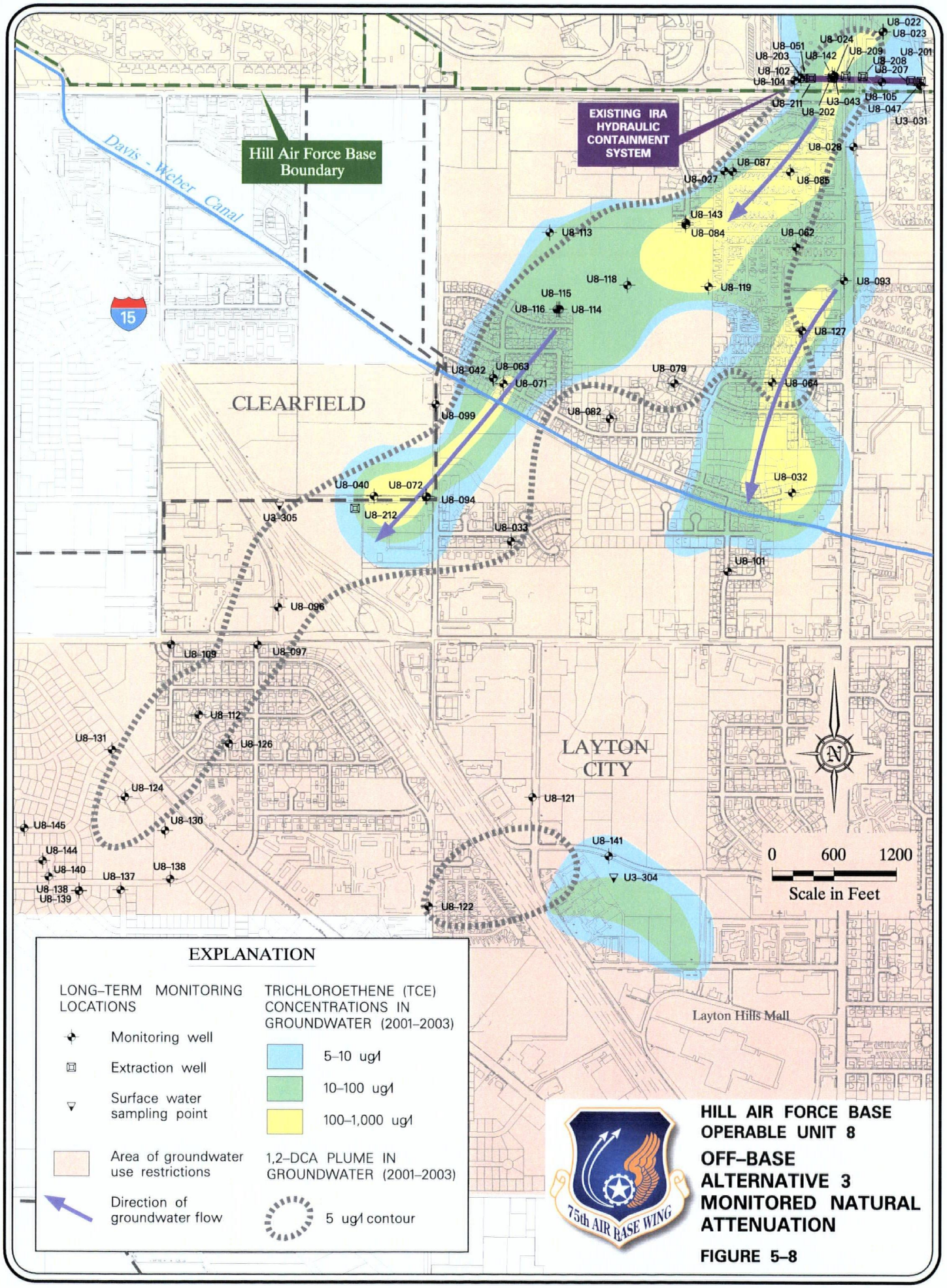
FILE



PLOT DATE/TIME 16-MAR-2005 17:26

I:\hill_afb\dgn\ou8\8ROD3_05\5_07off2ROD305.dgn

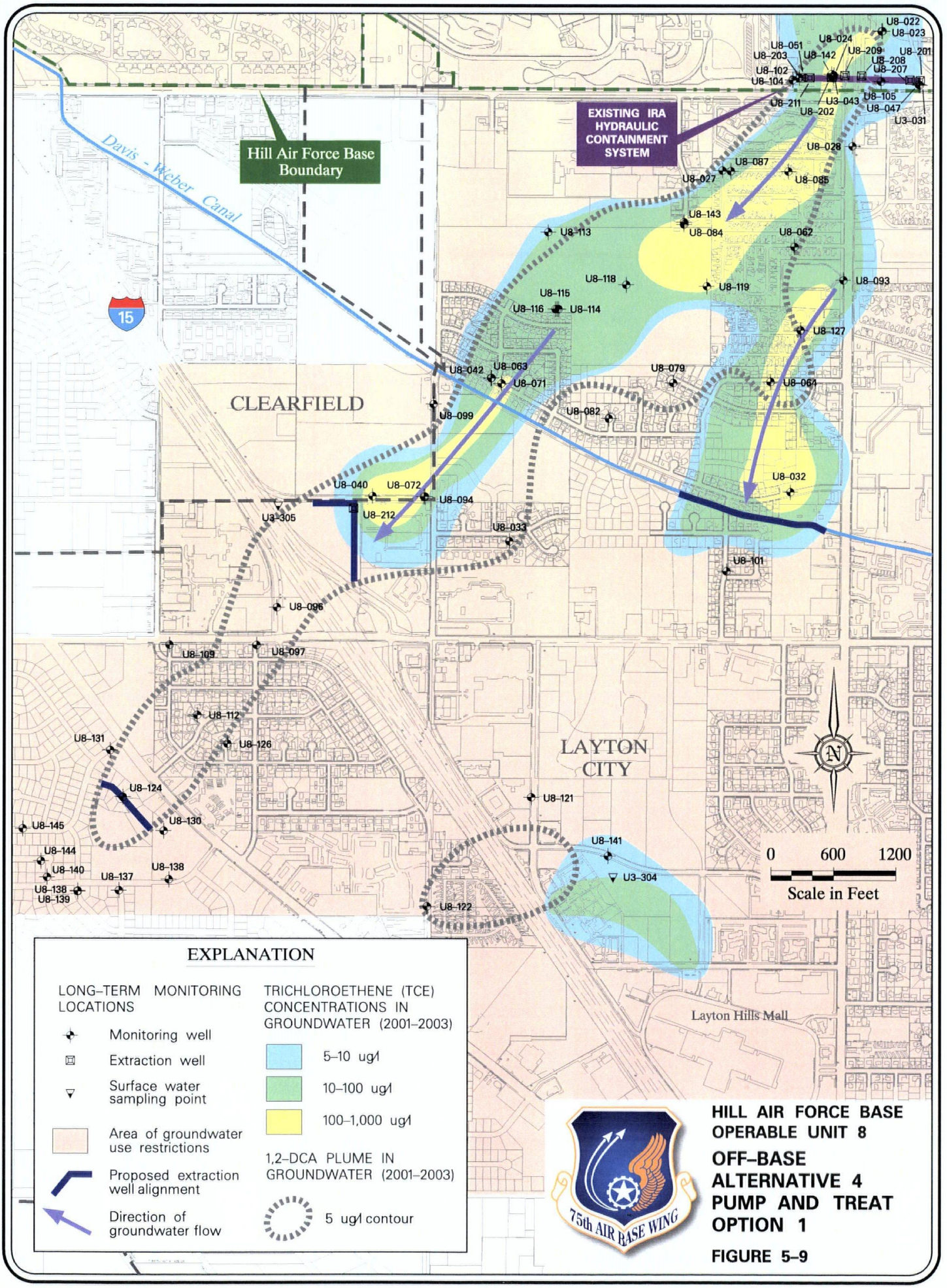
FILE



PLOT DATE/TIME 16-MAR-2005 17:28

I:\hill_afb\dgn\ou8\8ROD3_05\5_08off3ROD305.dgn

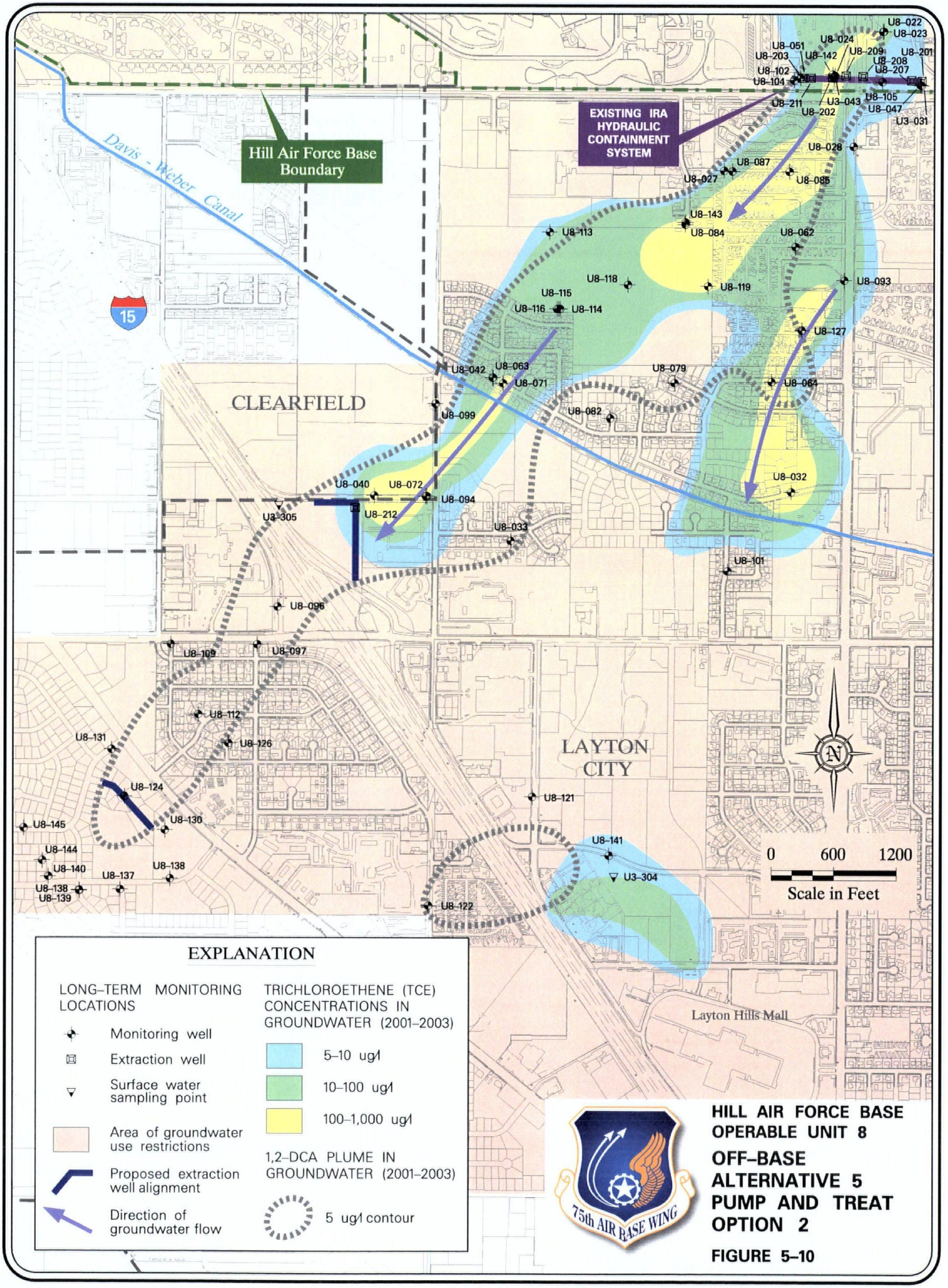
FILE



PLOT DATE/TIME 16-MAR-2005 17:30

I:\hill_afb\dgn\ou8\8ROD3_05\5_09off4ROD305.dgn

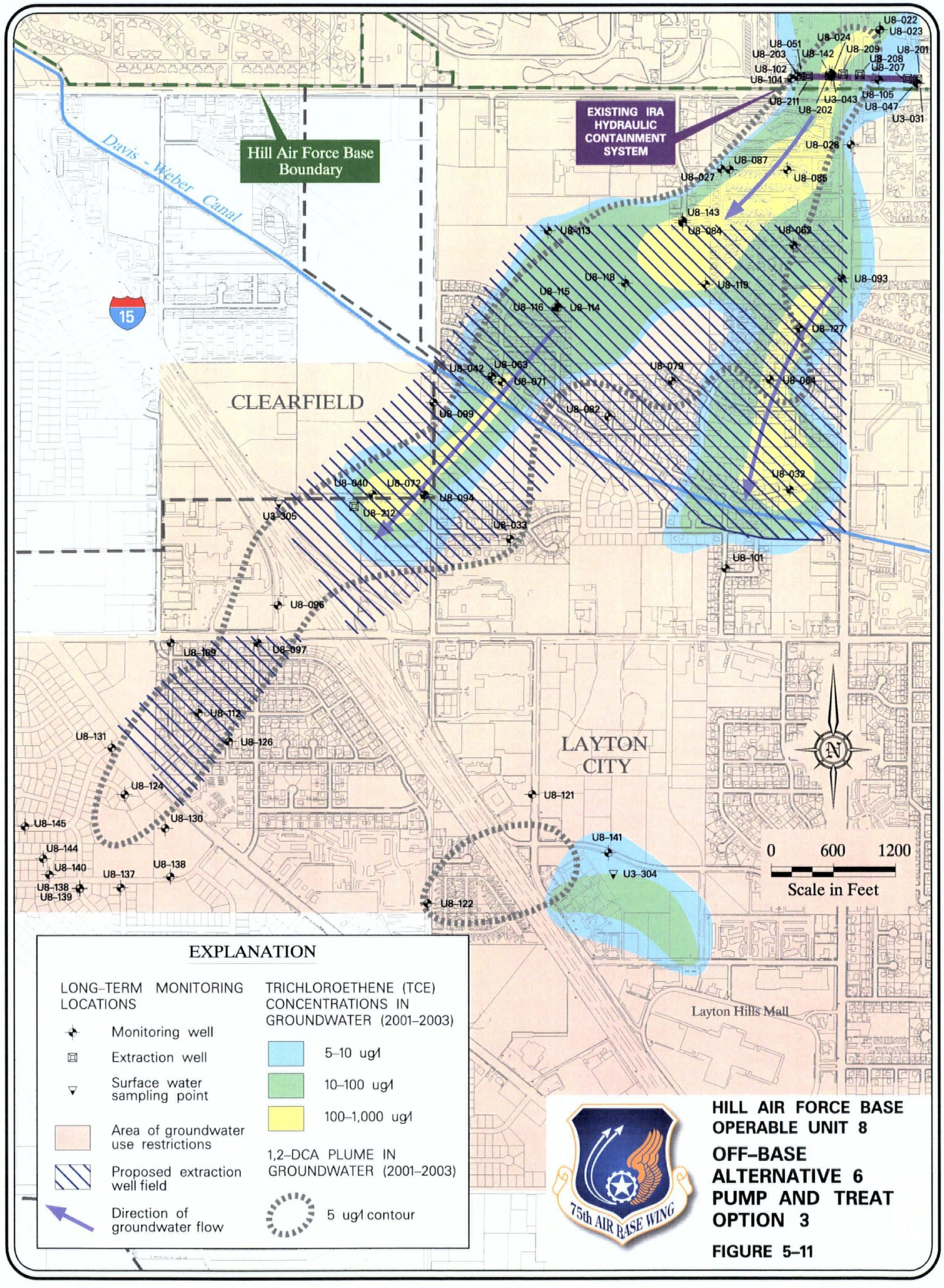
FILE



PLOT DATE/TIME 16-MAR-2005 17:42

I:\hill_afb\dgn\ou8\8ROD3_05\5_10of5ROD305.dgn

FILE



PLOT DATE/TIME 16-MAR-2005 17:44

I:\hill_afb\dgn\ou8\8ROD3_05\5_11off6ROD305.dgn

FILE

Section 6

Summary of the Comparative Analysis of Alternatives

6.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

6.0.0.1. The comparative analysis evaluates relative performance of the alternatives within the nine evaluation criteria established in the NCP listed below. The first two evaluation criteria are threshold criteria that must be met by the selected remedial action(s). The five balancing criteria are balanced to achieve the best overall solution. The final two modifying criteria considered in the remedy selection are State acceptance and community acceptance.

6.0.0.2. Threshold criteria include overall protection of human health and the environment as well as compliance with ARARs. These threshold criteria must be met by an alternative before it can be evaluated under the five balancing criteria.

- Overall Protection of Human Health and the Environment addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled.

- Compliance with ARARs addresses whether a remedy will meet all applicable or relevant and appropriate federal and State environmental laws and/or provide grounds for a waiver.

6.0.0.3. The five balancing criteria form the basis of the comparative analysis because they allow tradeoffs among the alternatives requiring different degrees of performance.

- Long-Term Effectiveness and Permanence refers to the ability of a remedy to provide reliable protection of human health and the environment over time.

- Reduction of Toxicity, Mobility, or Volume through Treatment refers to the preference for a remedy that reduces health hazards of contaminants, the movement of contaminants, or the quantity of contaminants at OU 8 through treatment at the site.

- Short-Term Effectiveness addresses the period of time needed until protection is achieved, and any adverse effects to human health and the environment that may be caused during the construction and implementation of the remedy.

- Implementability refers to the technical and administrative feasibility of an alternative or a remedy, and the availability of goods and services needed to implement the alternative.

- Cost evaluates the estimated capital, operation, and maintenance costs of each alternative.

6.0.0.4. The modifying criteria are generally addressed in response to comments from the State and the public, after issuance of the Proposed Plan.

- State Acceptance indicates whether the State agrees with, opposes, or has no comment on the preferred alternative.

- Community Acceptance indicates whether the community agrees with, opposes, or has no comment on the preferred alternative.

6.1 COMPARATIVE ANALYSIS OF ON-BASE ALTERNATIVES

6.1.0.1. Based on the individual evaluation and assessment of each on-Base remedial alternative, a comparative analysis is presented in this section to evaluate the relative performance of the five alternatives in relation to each specific evaluation criterion. The comparative analysis identifies the advantages and disadvantages of each alternative relative to the others so that key tradeoffs can be reviewed during the decision-making process for preparation of the Proposed Plan. A summary of the comparative analysis for the on-Base alternatives is presented in Table 6-1.

6.1.1 Overall Protection of Human Health and the Environment

6.1.1.1. The NCP requires all alternatives be assessed to determine whether they can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site by eliminating, reducing, or controlling exposures to such substances, pollutants, or contaminants. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

6.1.1.2. On-Base Alternative 1 will provide protectiveness because the plume is predicted to remain within the Base boundaries. On-Base Alternatives 2 and 3 are more protective because institutional controls (see Section 5.1.1) are employed to prevent groundwater use. On-Base Alternative 4 provides more overall protectiveness as extraction of contaminants from the plume will speed the removal of the contaminant mass within the on-Base plume, thereby reducing the level of future risk associated with the groundwater. On-Base Alternative 5 provides the most protectiveness by extraction of contaminated groundwater over a larger area of the plume, which will speed the removal of contaminant mass within the on-Base groundwater plume at a greater rate than On-Base Alternative 4. Groundwater contamination will remain in localized areas for all on-Base alternatives as long as ongoing sources remain.

6.1.2 Compliance with ARARs

6.1.2.1. The ability to comply with groundwater quality ARARs is the main differentiator between alternatives. Compliance with the non-degradation rule is achieved by all alternatives. Although future limited migration of the plume will initially violate the State of Utah non-degradation rule Utah Administrative Code (UAC R315-101-3), groundwater modeling predicts that within 30 years the areal extent of the plume will be smaller than as presently shown under all on-Base alternatives. Based on the results of the groundwater model, On-Base Alternatives 1, 2, and 3 will comply with the chemical specific ARARs over much of the current plume area within 30 years. Because source terms are included in the on-Base contaminant transport model, localized areas of

contamination above MCLs remain indefinitely. On-Base Alternative 1 does not meet ARARs because risk associated with residual groundwater contamination will remain and this alternative does not include institutional controls necessary to manage that risk, as required by state rule R315-101. All other on-Base alternatives comply with this requirement.

6.1.2.2. On-Base Alternative 4 reduces contaminant concentrations to below ARARs over much of the current extent of the plume slightly faster (by approximately 5 years, 25 years from remedy initiation) than On-Base Alternatives 1, 2, and 3 through active mass removal. On-Base Alternative 5 reduces contaminant concentrations sooner than all preceding alternatives (i.e., by approximately 10 years, 20 years from remedy initiation) through active extraction and treatment of groundwater across the on-Base plume. Due to the potential presence of continuing sources in all on-Base alternatives, the results of future monitoring should be used to determine if it is appropriate to seek/request implementation of the non-MCL level cleanup provisions of UAC R315-101 and R311-211 (and federal equivalents). The need for invoking these provisions would be evaluated based on the results of future monitoring and the statutory five-year remedial action reviews. The source control and management required in these regulations have been achieved through implementation of the remedial actions at OUs 3 and 7, the continued operation of the OU 8 IRA Hydraulic Containment System, and institutional controls (see Section 5.1.1) in on-Base Alternatives 2 through 5.

6.1.3 Long-Term Effectiveness and Permanence

6.1.3.1. On-Base Alternative 1 will provide long-term effectiveness and permanence because the plume is predicted to remain within Hill AFB boundaries (assuming Hill AFB remains within the jurisdiction of the DOD). All on-Base alternatives include continued operation of the OU 8 IRA Hydraulic Containment System. On-Base Alternatives 2 and 3 provide more long-term effectiveness and permanence than Alternative 1 through implementation of institutional controls (see Section 5.1.1), which restricts the use of groundwater. Application of institutional controls would be required as long as ongoing sources remain and thus contaminant concentrations remain above

MCLs in localized areas. On-Base Alternative 4 provides more long-term effectiveness and permanence than On-Base Alternatives 1, 2, and 3 through removal of contaminant mass in limited areas, while On-Base Alternative 5 provides the most long-term effectiveness and permanence through removal of contaminant mass over a greater area.

6.1.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

6.1.4.1. The on-Base alternatives rank similarly with respect to reduction of toxicity, mobility, and volume. That is, the more active the treatment, the more reduction of toxicity, mobility and volume is obtained. On-Base Alternatives 1, 2, and 3 are similar in providing minimal reduction in toxicity, mobility, and volume through natural attenuation processes. However only On-Base Alternative 3 monitors these processes to confirm and document reductions in toxicity, mobility, and volume. On-Base Alternative 4 provides more reduction in toxicity, mobility, and volume using active extraction and treatment, while On-Base Alternative 5 provides the most reduction in toxicity, mobility, and volume through a larger extraction system and subsequent treatment.

6.1.5 Short-Term Effectiveness

6.1.5.1. On Base, a borderline cancer risk to workers from inhalation of contaminants exists only in the Berman Pond area, so in general, On-Base Alternatives 1 through 3 present little short-term risks to the community or workers. On-Base Alternatives 4 and 5 may present some significant short-term risks during construction of the numerous extraction wells and associated piping in high traffic and heavily used areas of Hill AFB. These short-term risks may be managed by following standard health and safety practices, proper construction safety measures, and by implementing appropriate traffic plans.

6.1.6 Implementability

6.1.6.1. On-Base Alternatives 1 through 3 are easily implemented, both technically and administratively. Because the extraction wells (and associated piping) need to be installed in high traffic, high utility density, and heavily used areas, On-Base Alternatives

4 and 5 present significant technical implementability issues related to construction and long-term O&M. Many of the wells will be installed in or near the edges of streets, which will make it difficult to perform routine O&M activities at these wells. Also, many wells will likely be installed where security issues may prevent time critical access for performance of O&M activities.

6.1.7 Cost

6.1.7.1. The costs for On-Base Alternatives 1 and 2 are essentially the same, with the difference being in the costs associated with the implementation of institutional controls (see Table 6-1). However, most of the cost for these alternatives is associated with groundwater monitoring and with continued O&M of the existing OU 8 IRA Hydraulic Containment System. The cost for On-Base Alternative 3 is higher than for Alternatives 1 and 2, reflecting increased costs associated with implementation of monitored natural attenuation. Costs for On-Base Alternative 4 are less than On-Base Alternative 5 because of fewer wells and treatment volumes required for this alternative. The costs for On-Base Alternative 5 are significantly higher than all other alternatives, due to the costs associated with installation, operation, maintenance, and sampling of the groundwater extraction, treatment, and discharge systems.

6.2 COMPARATIVE ANALYSIS OF OFF-BASE ALTERNATIVES

6.2.0.1. Based on the individual evaluation and assessment of each off-Base remedial alternative, a comparative analysis is presented in this section to evaluate the relative performance of the six alternatives in relation to each specific evaluation criterion. The comparative analysis identifies the advantages and disadvantages of each alternative relative to the others so that key tradeoffs can be reviewed during the decision-making process for preparation of the Proposed Plan. A summary of the comparative analysis for the off-Base alternatives is presented in Table 6-2.

6.2.1 Overall Protection of Human Health and the Environment

6.2.1.1. Off-Base Alternative 1 is the least protective of the off-Base alternatives because no action is taken to actively reduce contaminant concentrations in off-Base groundwater, nor are institutional controls in place to prevent use of contaminated groundwater. Currently, existing contamination in three localized areas poses a borderline cancer risk to residents inhaling contaminants volatilizing from shallow groundwater. Significant future risks would exist if contaminated groundwater were used for drinking water. Alternatives 2 through 6 include institutional controls (see Section 5.1.1) that restrict groundwater use, and they are more protective than Off-Base Alternative 1. Off-Base Alternatives 4, 5, and 6 provide more protectiveness than Off-Base Alternatives 1, 2, and 3 by controlling migration of high concentration groundwater and preventing human contact with groundwater. Off-Base Alternative 4 may provide more protectiveness than Off-Base Alternative 5 due to active extraction of both the eastern and western portions of the off-Base plume. Relative to the other alternatives, Off-Base Alternative 6 provides the most protectiveness by extracting contaminants across the off-Base plume.

6.2.2 Compliance with ARARs

6.2.2.1. Based on the ARARs compliance discussions presented in preceding sections, the ability to comply with groundwater quality and state non-degradation rule ARARs is the main differentiator between off-Base alternatives. Off-Base Alternative 1 does not meet ARARs because risk associated with groundwater contamination will remain and this alternative does not include institutional controls necessary to manage that risk, as required by state rule R315-101. All other off-Base alternatives comply with this requirement. Off-Base Alternatives 1, 2 and 3 would not comply with the chemical specific ARARs within 150 years as no action is taken to reduce contaminant concentrations in groundwater, specifically with respect to 1,2-DCA. In addition, Off-Base Alternatives 1 through 3 do not comply with the non-degradation rule ARAR because the off-Base plume will continue to migrate, particularly the western region of the 1,2-DCA plume. Based on modeling, off-Base Alternatives 4 and 5 will achieve compliance with ARARs within 65 years through active extraction and treatment of

groundwater. Off-Base Alternative 6 would comply with ARARs in approximately 60 years through active extraction and treatment of groundwater across the off-Base plume. Known sources have been controlled by remedial actions already performed under RODs for OUs 3 and 7, and the inclusion of the OU 8 IRA Hydraulic Containment System in all of the on-Base remedial alternatives.

6.2.3 Long-Term Effectiveness and Permanence

6.2.3.1. Off-Base Alternatives 1, 2, and 3 do not provide long-term effectiveness and permanence as no action is taken to reduce contaminant concentrations, and current cancer risks at the low end of the potentially acceptable risk range and future risks would only decline through natural attenuation processes. Application of institutional controls (see Section 5.1.1) in Off-Base Alternatives 2 and 3 would prevent future contact with contaminated groundwater, but existing and future risks to residents from inhalation of contaminants that volatilize from shallow groundwater would remain for some time. Off-Base Alternatives 4, 5, and 6 may provide long-term effectiveness and permanence, but long-term operation of the extraction systems would be required. Further, contaminant concentrations would decrease slowly, with risk levels dropping concurrently.

6.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

6.2.4.1. For essentially the reasons described for the criterion long-term effectiveness and permanence, the off-Base alternatives rank similarly with respect to reduction of toxicity, mobility, and volume. That is, the more active the treatment, the more reduction of toxicity, mobility and volume is obtained. Off-Base Alternatives 1, 2, and 3 reduce toxicity, mobility, and volume through natural attenuation processes. However only Off-Base Alternative 3 monitors these processes to confirm and document reductions in toxicity, mobility, and volume. Off-Base Alternative 4 provides more reduction in toxicity, mobility, and volume than Off-Base Alternative 5 through extraction and treatment of contaminated groundwater from both the eastern and western portions of the off-Base plume. Off-Base Alternative 6 provides the most reduction in toxicity, mobility, and volume through treatment by extracting and treating contaminated groundwater throughout the off-Base plume.

6.2.5 Short-Term Effectiveness

6.2.5.1. Off Base, a borderline cancer risk to workers from inhalation of contaminants exists in three localized areas, but in general, Off-Base Alternatives 1 through 3 present little short-term risks to workers. Off-Base Alternatives 1 through 6 will have an ongoing borderline risk to the community as a result of inhalation of contaminant vapors from shallow groundwater until contaminant concentrations decrease. These risks are higher for Off-Base Alternatives 1 through 3, than for Off-Base Alternatives 4 through 6, due to longer clean-up times. Off-Base Alternatives 4, 5, and 6 presents some significant short term risks to workers and residents during construction of the extraction wells and associated piping in residential areas off-Base (particularly Alternative 6). These risks may be controlled, but not eliminated, through following standard health and safety practices, proper construction safety measures, and by implementing appropriate traffic plans.

6.2.6 Implementability

6.2.6.1. Off-Base Alternatives 1 through 3 are easily implemented, both technically and administratively. Because of the large number of wells (and associated piping) needing to be installed in residential and high traffic, heavily used areas, Off-Base Alternatives 4 and 5, and in particular, Off-Base Alternative 6 presents significant technical implementability issues related to constructability and long-term O&M. Many of the wells will be installed in or near the edges of streets, which will make it difficult to perform routine O&M activities at these wells. Further, due to the large number of wells, O&M activities will be required relatively frequently.

6.2.7 Cost

6.2.7.1. The costs for Off-Base Alternatives 1 and 2 are essentially the same, with the difference being in the costs associated with the implementation of institutional controls (see Table 6-2). However, most of the cost for these alternatives is associated with groundwater monitoring. The cost for Off-Base Alternative 3 is higher than for Off-Base Alternatives 1 and 2, reflecting increased costs associated with implementation of

monitored natural attenuation. Costs for Off-Base Alternative 4 through 6 are higher than for Off-Base Alternatives 1 through 3 due to the costs associated with implementation of active extraction of the TCE plumes and 1,2-DCA plume. Costs are less for Off-Base Alternative 5 compared to Off-Base Alternative 4 due to the decreased number of wells installed for extraction of the western plume only. Implementation of Off-Base Alternative 6 increases the cost of the remedy significantly due to the large number of wells required, associated piping, and treatment systems.

TABLE 6-1

COMPARATIVE ANALYSIS OF ON-BASE REMEDIAL ALTERNATIVES
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

	NCP Criteria:						
Remedial Alternative	*Protectiveness*	*Compliance with ARARs*	*Long Term-Effectiveness and Permanence*	*Reduction in Toxicity, Mobility, And Volume through Treatment*	*Short-Term Effectiveness*	*Implementability*	*Cost*
Alternative 1: No Further Action	Yes	No	Yes	No	Yes	Yes	$4.6M
Alternative 2: Limited Action	Yes	Yes	Yes	No	Yes	Yes	$4.6M
Alternative 3: MNA	Yes	Yes	Yes	Yes	Yes	Yes	$5.5M
Alternative 4: Pump and Treat Option 1	Yes	Yes	Yes	Yes	Possible-No	Possible-No	$10.7M
Alternative 5: Pump and Treat Option 2	Yes	Yes	Yes	Yes	Possible-No	Possible-No	$14.9M

Notes:

ARARs Applicable or Relevant and Appropriate Requirements
NCP National Contingency Plan
MNA Monitored Natural Attenuation

TABLE 6-2

COMPARATIVE ANALYSIS OF OFF-BASE REMEDIAL ALTERNATIVES
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Remedial Alternative	**NCP Criteria:** *Protectiveness*	*Compliance with ARARs*	*Long Term-Effectiveness and Permanence*	*Reduction in Toxicity, Mobility, and Volume through Treatment*	*Short-Term Effectiveness*	*Implementability*	*Cost*[b]
Alternative 1: No Action	Possible-No	No	No	No	Possible-Yes	Yes	$2.1M
Alternative 2: Limited Action	Yes [(a)]	No	Yes [(a)]	No	Possible-Yes	Yes	$2.1M
Alternative 3: MNA	Yes [(a)]	No	Yes [(a)]	Possible-Yes	Possible-Yes	Yes	$3.0M
Alternative 4: Pump and Treat Option 1	Yes [(a)]	Yes	Yes [(a)]	Yes	Possible-No	Possible-No	$17.2M
Alternative 5: Pump and Treat Option 2	Yes	Yes	Yes	Yes	Possible-No	Possible-No	$10.8M
Alternative 6: Pump and Treat Option 3	Yes	Yes	Yes	Yes	Possible-No	Possible-No	$22.6M

Notes:
ARARs Applicable or Relevant and Appropriate Requirements
NCP National Contingency Plan
MNA Monitored Natural Attenuation

(a) Assumes $3x10^{-6}$ residual cancer risk for air exposure is acceptable.
(b) Cost ranges shown for alternative 4 through 6 represent costs associated with the anticipated minimum and maximum number of extraction wells.

Section 7

The Selected Remedy

7.0 THE SELECTED REMEDY

7.1 DESCRIPTION OF THE SELECTED REMEDY

7.1.0.1. The selected remedy at Hill AFB OU 8 consists of implementing On-Base Alternative 3 and Off-Base Alternative 5. Components of On-Base Alternative 3 and Off-Base Alternative 5 are graphically illustrated in Figures 5-3 and 5-10, respectively, and are summarized in Figure 7-1. As with previous sections, discussions of on-Base and off-Base areas are presented separately. A summary the selected alternatives are presented below.

7.1.0.2. On-Base Alternative 3 – Monitored Natural Attenuation. On-Base Alternative 3 consists of the following components:

- Implementation of MNA to remediate on-Base groundwater
- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater
- Continued operation of the OU 8 Hydraulic Containment System
- Groundwater monitoring, including monitoring of parameters to verify/confirm natural attenuation processes are occurring.

7.1.0.3. The institutional controls to be implemented for this alternative include (see Section 5.1.1 for more detail):

- Maintaining the requirements of AFI-32-7020 prohibiting any construction or other activity that will disturb contaminated groundwater or interfere with remedial action equipment and facilities unless the proposed activity receives the concurrence of the EPA and UDEQ.

- Hill AFB EM review of all construction proposals (Hill AFB's "332 process") to ensure the requirements of AFI-32-7020 are met.

- State water rights and well-drilling restrictions to prevent exposure to contaminated groundwater. Areas of OU 8 covered by these restrictions are shown in Figures 5-2 through 5-11 and are summarized in Figure 5-12. The UDWR regulates appropriation and distribution of all water within the State of Utah, and has developed a groundwater management plan for the Weber Delta area, which includes Hill AFB. As per this plan, areas of groundwater contamination associated with OU 8 (and other Hill AFB OUs) are identified as restricted, and installation of wells in the shallow aquifer in this area is not permitted. Hill AFB will send a letter to UDWR annually requesting verification of continuing enforcement of these restrictions throughout the life of the remedy.

Groundwater monitoring, including monitoring of parameters to verify/confirm natural attenuation, will be defined in the PSVP for OU 8, which describes the data quality objectives (DQO) and proposed monitoring programs that will monitor the progress toward achieving the remediation goals and ultimate achievement or resolution of these goals.

7.1.0.4. Off-Base Alternative 5 – Pump and Treat Option 2. Off-Base Alternative 5 consists of the following components:

- Installation and operation of groundwater extraction wells in two areas to extract contaminated groundwater

- Continued implementation of institutional controls to restrict the use of shallow contaminated groundwater

- Groundwater monitoring.

The institutional controls to be implemented for this off-Base alternative include (see Section 5.1.1 for more detail):

- State restrictions on the installation of new wells in the shallow aquifer. Hill AFB will request annual verification from the State Engineer that the restrictions are still in place and being enforced.

- Hill AFB will acquire and maintain property leases and easements for remediation systems and monitoring locations. The leases will be renewed as needed and will remain in effect throughout the life of the remedy.

7.1.0.5. Elements of the remedy common to both On-Base Alternative 3 and Off-Base Alternative 5 include the following:

- Continued implementation of institutional controls to prohibit the use of shallow contaminated groundwater

- Groundwater monitoring to track projected declines in contaminant concentrations over time in accordance with the OU 8 PSVP

- Throughout the treatment time period, other technologies, including innovative technologies, may be reviewed for possible application as either a test or demonstration of the technology. If the results of such application(s) are deemed effective as a treatment technology within the constraints of the RAOs given here, then the technology may be added to the selected remedy.

7.1.0.6. The goal of the On-Base Alternative 3 remedial action is to restore on-Base groundwater to MCLs within a reasonable timeframe while preventing potential use of contaminated shallow groundwater. This alternative will also prevent migration of contaminants from on-Base source areas to off-Base areas through continued operation of the IRA Hydraulic Containment System and through natural attenuation of the groundwater contaminants. The ability to prevent migration will be evaluated through performance monitoring of the IRA Hydraulic Containment System to verify

containment, and through groundwater monitoring to track projected contaminant concentration declines over time and to verify/confirm natural attenuation. A periodic review of the remedial action will occur at least every 5 years in accordance with CERCLA Section 121(c) (five-year review). If the selected remedy cannot meet remediation goals (as determined by the results of at least one five-year review or one Performance System Verification Report (PSVR), the following additional measures may be considered:

- Any other remedial technologies, including innovative technologies, for groundwater restoration.

- Seeking non-MCL level cleanup provisions of UAC R315-101 and R311-211

7.1.0.7. The decision to invoke any or all of these measures will be made during a periodic review of the remedial action, which will occur at least every 5 years in accordance with CERCLA Section 121(c). The results of the five-year review will be documented in the PSVR and in the five-year review report. The PSVR may also be used as a basis to invoke these changes if the time period for the PSVR is other than five years (i.e., not coincident with the five-year review).

7.1.0.8. The goal of the Off-Base Alternative 5 remedial action is to restore off-Base groundwater to MCLs within a reasonable timeframe using extraction wells to remove contaminated groundwater and to prevent further migration of contaminated groundwater. This alternative will also prohibit potential use of shallow contaminated groundwater through implementation of institutional controls (see Section 5.1.1). The ability to remove contaminants and prevent further plume migration will be evaluated through performance monitoring of the groundwater extraction system to verify mass removal and containment, and through groundwater monitoring to track projected contaminant concentration declines over time. If the selected remedy cannot meet remediation goals (as determined by the results of at least one PSVR or five-year review), additional measures identified below will be considered.

7.1.0.9. The selected remedy off-Base will include groundwater extraction and potential treatment over a period of approximately 65 years, during which the system's performance will be carefully monitored on a regular basis and adjusted as warranted by performance data collected during operation. System modifications may include any or all of the following:

- Discontinuing operation of extraction wells where cleanup goals have been attained; however, subsequent monitoring will be performed for 2 to 5 years to ensure cleanup goals have been attained

- Alternating extraction rates to eliminate stagnation points, or to encourage adsorbed contaminants to partition into groundwater, as long as containment is not compromised

- Installation of additional extraction wells to facilitate or accelerate mass removal and/or containment.

7.1.0.10. If groundwater cleanup levels cannot be achieved, as determined from the results of the five-year review or the PSVR, the following long-term measures may be implemented as a modification to the existing system, for an indefinite period of time:

- Any other remedial technologies, including innovative technologies such as in-situ bioremediation, permeable reactive barriers, etc., for groundwater restoration.

- Seeking non-MCL level cleanup provisions of UAC R315-101 and R311-211

- In the event the land use is changed or structures are removed, the Air Force will evaluate the protectiveness of the remedy selected for Operable Unit 8 and will take any appropriate remedial action.

7.1.0.11. The decision to invoke any or all of these measures will be made during a periodic review of the remedial action, which will occur at least every 5 years in

accordance with CERCLA Section 121(c). The results of the five-year review will be documented in the PSVR. The PSVR may also be used as a basis to invoke these changes if the time period for the PSVR is other than five years (i.e., not coincident with the five-year review).

7.1.1 Remediation Goals and Performance Standards

7.1.1.1. In an effort to protect human health and the environment, RAOs and preliminary remediation goals were established in the OU 8 FS to address potential future unacceptable risk scenarios, as described in Section 5.0. Based on these RAOs, quantitative PRGs were developed to define the extent of remedial action. The following section presents the PRGs and defines the volumes of affected groundwater (areas of attainment) that were described in detail in the FS. As described in detail in the FS and in Section 5.0, PRGs establish concentrations of contaminants of concern that will not pose an unacceptable risk to human health and the environment. For contaminants found in OU 8 groundwater, MCLs are considered the PRGs for achieving site RAOs.

7.1.1.2. Groundwater Performance Standards. As described above, RAOs for both on- and off-Base groundwater include preventing human contact with contaminated groundwater containing compounds that present a risk to human health. Implementing institutional controls (see Section 5.1.1) to prohibit use of contaminated groundwater throughout the extent of the on- and off-Base plumes will provide this protection. Further, preventing migration of contamination will be achieved through monitored natural attenuation for on-Base groundwater and through groundwater extraction and treatment for off-Base groundwater. To achieve reduction of contaminants in groundwater to PRGs in a reasonable time, concentrations of contaminants in groundwater will be monitored for the duration of the remedy and will be compared to the site PRGs, which are shown in Table 7-1.

7.1.1.3. The area of attainment defines the area over which concentrations of one or more contaminants in the shallow groundwater exceed the PRGs for groundwater. Figure 7-2 shows the area of attainment defined by the PRGs for both the on- and off-Base areas. The area of attainment for on-Base groundwater encompasses approximately 300 acres,

while the area of attainment for off-Base groundwater also encompasses approximately 300 acres. Assuming an effective porosity of 25 percent and an average saturated thickness between 80 to 100 feet, the total estimated volume of groundwater within the entire area of attainment (i.e., on- and off-Base areas together) is approximately 4 billion gallons.

7.1.1.4. Achievement of Remedial Action Objectives. As detailed in the FS and the Proposed Plan, the selected remedy is designed to address each of the remedial action objectives and PRGs, as well as ensure that these objectives and goals are met. To this end, the selected remedy will prevent migration of contaminants in groundwater through monitored natural attenuation on-Base, continued operation of the IRA Hydraulic Containment System, and active groundwater extraction off-Base. The selected remedy will also prevent unacceptable exposure scenarios with regard to groundwater by providing institutional controls. The selected remedy will restore groundwater through natural attenuation in the on-Base area and through groundwater extraction and mass removal in the off-Base areas. The selected remedy also provides environmental monitoring and monitored natural attenuation (on-Base) to monitor compliance towards remediation objectives and goals.

7.1.1.5. Compliance and Performance Monitoring. The CERCLA process requires regular monitoring to ensure that the selected remedy for OU 8 is in compliance with regulatory requisites, is achieving appropriate protection of human health and the environment, and is continuing to pursue attainment of remediation goals. Performance monitoring is conducted to evaluate the effectiveness of the remedy and to ensure protection of human health and the environment. Compliance monitoring is conducted to determine compliance with applicable laws, regulations, and permit conditions.

7.1.1.6. Groundwater remediation system monitoring programs will be implemented at OU 8 in an effort to determine if, and to what degree, remedial measures implemented to date and individual components of the selected remedy are helping to achieve these objectives. A PSVP will be prepared during remedial design and prior to implementation of the selected remedy. The PSVP will more fully describe the DQOs and proposed

monitoring programs that will monitor the progress toward achieving the remediation goals and ultimate achievement or resolution of these goals.

7.1.2 Restoration Time Frame

7.1.2.1. Detailed and comprehensive groundwater flow and contaminant transport modeling was conducted as part of the OU 8 FS. Based on this modeling, the restoration timeframe for on-Base groundwater is estimated to be at least 30 years. Because continuing sources of contaminants were assumed in the on-Base computer model, localized areas of contamination above MCLs are likely to remain indefinitely. The restoration timeframe for off-Base groundwater is estimated to be approximately 65 years. This timeframe estimate assumes continued operation of the IRA Hydraulic Containment System.

7.1.3 Costs

7.1.3.1. The estimated capital and total costs for remediating OU 8 groundwater using On-Base Alternative 3 (Monitored Natural Attenuation) and Off-Base Alternative 5 (Pump and Treat Option 2) are shown in Table 7-2. On-Base Alternative 3 does not involve any capital costs. The total estimated capital costs for remediating off-Base groundwater is estimated at $2,332,000, with an accuracy range of +50/-30 percent. These capital costs include the following items: groundwater extraction well installation; trenching and backfilling; piping installation; instrumentation and process control; equipment installation and startup; O&M Plan preparation; and contingency costs.

7.1.3.2. Net present value (NPV) costs for both On-Base Alternative 3 and Off-Base Alternative 5 were calculated for operation and maintenance of these alternatives over a 30-year period. Use of a 30-year NPV cost for alternative comparison is typically used in evaluating cleanup alternatives. Further, beyond 30 years, the NPV cost of an alternative will not change significantly. These costs were estimated with a +50/-30 percent accuracy, and are also shown in Table 7-2. As shown, the 30-year NPV cost for On-Base Alternative 3 and Off-Base Alternative 5 are estimated at $5,480,000 and $10,800,000, respectively. Annual O&M costs for On-Base Alternative 3 and Off-Base Alternative 5

are estimated at $310,715 and $434,000, respectively. Therefore, the total NPV cost for implementing the selected remedy for OU 8 is $16,280,000.

7.2 STATUTORY DETERMINATIONS

7.2.0.1. The selected remedy meets the statutory requirements of Section 121 of CERCLA as amended by SARA. These statutory requirements include protectiveness of human health and the environment, compliance with ARARs, cost-effectiveness, utilization of permanent solutions and alternative treatment technologies to the maximum extent practicable, and preference for treatment as a principal element. The manner in which the selected remedy for OU 8 meets each requirement is presented in the following section.

7.2.1 Protection of Human Health and the Environment

7.2.1.1. The selected remedy for OU 8 protects human health and the environment through the following:

- Prohibiting use of contaminated groundwater both on and off Base through continued implementation of institutional controls until completion of the remedy, thereby eliminating direct human contact with contaminated groundwater and eliminating future risk associated with consumption of contaminated groundwater; additionally, existing potable water supplies both on- and off-Base further minimize the potential for use of this contaminated groundwater

- Extraction of contaminated groundwater off Base using a series of pumping wells, which reduces contaminant concentrations in the groundwater and permanently removes contaminant mass from the aquifer. The groundwater may be treated and discharged directly to the stormwater system, discharged (untreated) directly to the local POTW for treatment, or discharged directly (untreated) to the stormwater system as long as concentrations remain below

the acceptable discharge limits set by the Utah Division of Water Quality for Kays Creek of the Farmington Bay Drainage.

- Reduction of contaminant mass in the groundwater through extraction and natural attenuation (on Base and off Base), thereby eliminating future risks due to air inhalation of contaminants volatilizing from contaminated groundwater to below levels of concern

- Containment of contaminated groundwater on Base through monitored natural attenuation of contaminants and through continued operation of the OU 8 IRA Hydraulic Containment System.

7.2.1.2. The selected remedy will not pose any unacceptable short-term risks. Institutional controls (described above and in Section 5.1.1) and proper health and safety procedures will be implemented during construction and monitoring of the remedy to minimize short-term risks to site workers and the community. Current risks associated with air inhalation of contaminants volatilizing from contaminated groundwater are minimal, as described in Section 4.0.

7.2.1.3. Because this remedy will result in hazardous substances remaining onsite above health-based levels based on certain exposure scenarios, a review will be conducted within five years after commencement of remedial action to ensure the remedy continues to provide adequate protection of human health and the environment. An independent and parallel review of treatment effectiveness will also be conducted in the PSVR with a timeline that may be different from the five-year review. The results of the PSVR may require changes to both the PSVP and the site management strategy.

7.2.2 Compliance with ARARs

7.2.2.1. Section 121(d)(1) of CERCLA, as amended by SARA, requires that the remedial actions for OU 8 must attain a degree of cleanup that assures protection of human health and the environment. Additionally, remedial actions that leave any hazardous substances, pollutants, or contaminants onsite must, upon completion, meet a level or standard that at

least attains ARARs under the circumstances of the release. ARARs will be adhered to during implementation of the selected remedy. All ARARs will be met upon completion of the selected remedy or a waiver will be justified. Federal and State chemical-, location-, and action-specific ARARs for the selected remedy are presented in Appendix A.

7.2.2.2. Chemical-Specific ARARs. The selected remedy will comply with chemical specific ARARs identified for the remedial actions to be undertaken, including those related to groundwater and discharge of treated or untreated groundwater.

7.2.2.3. The principal chemical-specific ARARs for the selected remedy includes the Federal Safe Drinking Water Act (42 USC Sec 300g, 40 Code of Federal Regulations [CFR Part 141, SubPart B];, Utah Corrective Action Cleanup Standards (UAC R311-211), and Utah Cleanup and Risk-Based Closure Standards (UAC R315-101). The MCLs (and hence, PRGs) for OU 8 contaminants are based on the Safe Drinking Water Act and are considered relevant and appropriate as cleanup standards for contaminated groundwater at OU 8.

7.2.2.4. As described in the FS, if, after evaluation of the performance of the selected remedy, it is determined that PRGs cannot reasonably be achieved, Hill AFB may request consideration of clean-up levels above the PRGs through provisions of UAC R311-211-3, R311-211-4, and R315-101 (and Federal equivalents). In this case, Hill AFB would have already achieved the source control and site management required to implement the alternative cleanup level provisions of these regulations.

7.2.2.5. Location-Specific ARARs. No location-specific ARARs were identified for the selected remedy.

7.2.2.6. Action-Specific ARARs. The selected remedy will comply with all action-specific ARARs, as identified in Appendix A. The principal action-specific ARARs include those governing discharge to surface waters or POTWs and VOC discharges to air in a non-attainment area.

7.2.3 Cost Effectiveness

7.2.3.1. The selected remedy is cost effective in addressing the principal risks posed by groundwater contamination within a reasonable timeframe. Section 300.430(f)(ii)(D) of the NCP requires evaluating cost effectiveness by comparing all of the alternatives that meet the threshold criteria against three additional balancing criteria that describe the alternatives overall effectiveness: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume (TMV) through treatment; and short-term effectiveness. A remedy is cost effective if its costs are proportionate to its overall effectiveness. As the selected remedy includes on- and off-Base alternatives, these are discussed separately below in terms of this requirement.

7.2.3.2. For the on-Base portion of OU 8, On-Base Alternative 3 (Monitored Natural Attenuation) provides the best overall effectiveness of all the alternatives considered proportional to the cost. As described in the FS, all on-Base alternatives provide long-term effectiveness and permanence. However, On-Base Alternatives 2 and 3 provide similar effectiveness and permanence but at significantly lower cost than the slightly greater effectiveness and permanence provided by On-Base Alternatives 4 and 5 (at 195 and 272 percent higher cost, respectively, as compared to On-Base Alternative 3). On-Base Alternative 3 provides more reliability than On-Base Alternative 2 by documenting decreases in contaminant concentrations through application of MNA, with only a 20 percent increased cost. Similarly, On-Base Alternatives 4 and 5 have greater reduction in TMV compared to the other alternatives, but again at a much greater cost than On-Base Alternative 3. Specifically, On-Base Alternatives 4 and 5 only produce a reduction in cleanup timeframe (i.e., quicker reduction in plume volume) of 16 and 33 percent, respectively, compared to On-Base Alternative 3, but at nearly 2 and 3 times higher cost. On-Base Alternatives 1, 2, and 3 all provide short-term effectiveness by preventing exposure to contaminated groundwater, but On-Base Alternatives 4 and 5 may present some short-term risks to Base workers and construction workers during construction of the extraction system in and along Base roadways. Hence, On-Base Alternative 3 provides the best long-term effectiveness and permanence, reduction in TMV, and short-term effectiveness for the least cost of the on-Base alternatives.

7.2.3.3. For the off-Base area of OU 8, Off-Base Alternative 5 (Pump and Treat Option 2) provides the best overall effectiveness of all the alternatives considered proportional to the cost. Off-Base Alternative 5 provides more long-term effectiveness than Off-Base Alternatives 1, 2, and 3, and only slightly less than Off-Base Alternatives 4 and 6. However, Off-Base Alternatives 4 does not provide any reduction in the cleanup timeframe as compared to Off-Base Alternative 5, yet with a 60 percent higher implementation cost. Off-Base Alternative 6 provides only an 8 percent reduction in cleanup timeframe compared to Off-Base Alternative 5, but at a 209 percent higher cost. For similar reasons, Off-Base Alternative 5 provides the best tradeoff of reliability versus costs among the off-Base Alternatives. Similarly, with respect to reduction of TMV, Off-Base Alternative 4 provides the best reduction in contaminant toxicity, mobility, and volume compared to the cost of implementation of the 6 off-Base alternatives developed for the off-Base area. With respect to providing short-term effectiveness, Off-Base Alternative 5 provides the best tradeoff of reducing risks associated with contaminated groundwater (from air inhalation), and presenting some short-term risks to the community and workers (from construction of the extraction systems in city and residential streets). That is, all of the pump and treat options (Off-Base Alternatives 4, 5, and 6) present some short term-risks to the community and workers because of the need to install extraction wells and piping systems in streets and in neighborhoods. However, Off-Base Alternative 5 requires the installation of the least number of wells, and therefore presents the smaller potential short-term risk at the least cost among Off-Base Alternatives 4, 5, and 6. Therefore, Off-Base Alternative 5 provides the best long-term effectiveness and permanence, reduction in TMV, and short-term effectiveness for the least cost among the off-Base alternatives.

7.2.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

7.2.4.1. The selected remedy meets the statutory requirement to use permanent solutions and treatment technologies to the maximum extent practicable. The selected remedy provides the best balance of tradeoffs among all of the alternatives with respect to the five balancing criteria, which include:

- Long-Term Effectiveness
- Reduction of Toxicity, Mobility, or Volume Reduction through Treatment
- Short-Term Effectiveness
- Implementability
- Cost.

7.2.4.2. Several aspects of the selected remedy use permanent solutions, which are statutorily preferred in the interests of public health and environmental protection. Monitored natural attenuation of on-Base groundwater will result in permanent removal of contaminants from the aquifer. The continued operation of the OU 8 IRA Hydraulic System at the Base boundary will permanently remove contaminants from the aquifer, and subsequent treatment at the North Davis County Sewer District treatment plant will destroy these compounds. Off Base, natural attenuation of contaminants will also permanently remove contaminants from the aquifer, and the pump and treat systems will permanently remove the extracted contaminants.

7.2.4.3. For the on-Base portion of OU 8, all of these criteria were critical in the selection decision, where On-Base Alternative 3 provided the most combined benefit of these criteria with the least relative cost. On-Base Alternatives 5 and 6 provided progressively more reduction in TMV, but at significantly increased cost and with potential implementability issues and possible short-term risks to site workers and Hill AFB workers during construction and during operations and maintenance of the remedy.

7.2.4.4. Similarly, Off-Base Alternative 5 provided the most combined benefit and tradeoffs between these criteria with the least cost of all of the off-Base alternatives. Off-Base Alternative 5 produced similar long-term effectiveness and permanence and reduction in TMV as Off-Base Alternatives 4 and 6, but at significantly lower cost. Additionally, Off-Base Alternatives 4 and 6 posed greater implementability and short-term effectiveness issues/risks during implementation and during operations and

maintenance than Off-Base Alternative 5 – and again at much greater cost than Off-Base Alternative 5.

7.2.5 Preference for Treatment as a Principal Technology

7.2.5.1. The selected remedy for OU 8 utilizes permanent solutions and treatment technologies to the maximum extent practicable. Extraction and subsequent treatment of extracted groundwater satisfies the statutory preference for actions that permanently and significantly reduce the volume, toxicity, and mobility of hazardous substances. Additionally, natural treatment processes are expected to permanently reduce the concentrations of contaminants in the aquifer.

7.3 DOCUMENTATION OF SIGNIFICANT CHANGES

7.3.0.1. No significant changes have been recommended or proposed for the selected remedy for OU 8 as a result of the OU 8 Proposed Plan Public Meeting and the Proposed Plan public comment period. However, consideration has been given regarding whether conducting certain groundwater monitoring parameters (ethane, ethene, methane) as part of On-Base Alternative 3 (Monitored Natural Attenuation) is necessary. As discussed in responses to comments received from the public (Appendix C), the need for conducting these parameters as part of the monitored natural attenuation for On-Base Alternative 3 will be evaluated after these analytes have been analyzed for in five monitoring rounds. If they are not detected in these five rounds, then these analytes will be dropped from subsequent sampling rounds.

TABLE 7-1

PRELIMINARY REMEDIATION GOALS FOR PRINCIPAL CONTAMINANTS OF CONCERN IN GROUNDWATER OPERABLE UNIT 8 HILL AIR FORCE BASE, UTAH

Compound	Preliminary Remediation Goal (µg/l)	Parameters Considered in Setting PRGs for Groundwater: Federal MCL (µg/l)	Utah GWQ Protection Standard (µg/l)	MCLG[a] (µg/l)	Concentration at which Excess Cancer Risk Equals 10^{-6}[b] (µg/l)	Concentration at which Excess Cancer Risk Equals 10^{-4} [b] (µg/l)	Concentration at which Hazard Quotient Equals 1[b] (µg/l)
Arsenic	**50**	10	50	--	--	--	--
Chromium (total)	**100**	100	100	100	--	--	--
Chromium (hexavalent)	**100**	--	--	--	--	--	--
Benzene	**5**	5	5	--	15/464	1,500/46,400	154/3,980
Chlorobenzene	**100**	100	100	100	--	--	2,920/74,200
Carbon Tetrachloride	**5**	5	5	--	0.76/25	76/2,500	12/328
Cis-1,2-Dichloroethene	**70**	70	70	70	--	--	696/18,300
1,1-Dichloroethene	**7**	7	7	7	0.18/6.1	18/605	126/3,530
1,2-Dichlorobenzene	**600**	600	600	600	--	--	22,700/556,000
1,2-Dichloroethane	**5**	5	5	--	11/284	1,050/28,400	571/2,910
1,2-Dichloropropane	**5**	5	5	--	6.7/201	671/20,100	219/5,460
Ethylbenzene	**700**	700	700	700	--	--	33,500/891,000
Tetrachloroethene	**5**	5	5	--	30/980	2,960/98,000	2,830/78,200
1,1,1-Trichloroethane	**200**	200	200	200	--	--	10,700/289,000
Trichloroethene	**5**	5	5	--	24/768	2,410/76,800	351/9,800
Toluene	**1,000**	1,000	1,000	1,000	--	--	10,800/284,000
Vinyl chloride	**2**	2	2	--	0.88/28	88/2,800	334/8,800

-- Value not available or applicable
µg/l micrograms per liter
GWQ groundwater quality
MCLG maximum contaminant level goal
(a) Only non-zero MCLGs are listed.
(b) Risk-based criteria derived from the volatilization of constituents from groundwater into indoor air. The first value is for an off-Base residential scenario, based on groundwater conditions at U8-042; the second value is for an on-Base industrial scenario based on conditions at WW-9. Note that these values are based on the Johnson and Ettinger indoor air model, whereas indoor air results had primacy in the baseline risk assessment. The indoor air modeling results will be considered only where sampling indicated a potential risk is present. These values are based on the risk assessment conducted for OU 8 as part of the remedial investigation (Montgomery Watson Harza, 2001).

TABLE 7-2

ESTIMATED COST FOR REMEDY IMPLEMENTATION
OPERABLE UNIT 8
HILL AFB, UTAH

Cost Item Description	Remedial Options	
	On-Base Alternative 3: Monitored Natural Attenuation	**Off-Base Alternative 5**: Pump and Treat Option 2 (Discharge to Storm Sewer After Treatment)
Total Direct Costs	$0	$2,330,000
Institutional Controls	$15,000	$15,000
Five Year Summary Reports	$95,800	$160,000
Annual O&M Costs	$310,715	$434,000
Total Net Present Value Cost	$5,480,000	$10,800,000

FILE *I:\hill_afb\dgn\ou8\8ROD3_05\7_01on_off5ROD_305.dgn* PLOT DATE/TIME *17-MAR-2005 11:04*

EXPLANATION

LONG-TERM MONITORING LOCATIONS

- Monitoring well
- Extraction well
- Surface water sampling point
- Area of groundwater use restrictions
- Proposed extraction well alignment
- Direction of groundwater flow

TRICHLOROETHENE (TCE) CONCENTRATIONS IN GROUNDWATER (2001–2003)

- 5–10 ug/l
- 10–100 ug/l
- 100–1,000 ug/l

1,2-DCA PLUME IN GROUNDWATER (2001–2003)

- 5 ug/l contour

N

0 1000 2000

Scale in Feet

U8–132 T–388–001 U8–006 U8–008 U8–133 U8–129 U7–011 U7–009 U7–007 U7–008 U8–108 U8–011 U8–017 WW–13 T–260–001 U8–056 U8–055 U3–054 U3–056 U8–107 U8–128 U8–015 U3–019R U9–010 U3–011 U8–016 U8–022 U8–023 U8–024 U8–051 U8–203 U8–142 U8–209 U8–201 U8–208 U8–207 U8–102 U8–104 U8–105 U8–211 U3–043 U8–047 U8–202 U3–031 U8–028 U8–087 U8–027 U8–085 U8–143 U8–084 U8–113 U8–062 U8–118 U8–119 U8–093 U8–115 U8–116 U8–114 U8–127 U8–042 U8–063 U8–071 U8–079 U8–064 U8–099 U8–082 U8–040 U8–072 U8–094 U3–305 U8–212 U8–033 U8–032 U8–101 U8–098 U8–109 U8–097 U8–112 U8–131 U8–126 U8–124 U8–121 U8–145 U8–130 U8–144 U8–140 U8–137 U8–138 U8–139 U8–141 U3–304 U8–122

EXISTING IRA HYDRAULIC CONTAINMENT SYSTEM

Hill Air Force Base Boundary

Davis - Weber Canal

CLEARFIELD

LAYTON CITY

North Ridge High School

15

HILL AIR FORCE BASE
OPERABLE UNIT 8

ELEMENTS OF SELECTED REMEDY ON-BASE ALTERNATIVE 3 AND OFF-BASE ALTERNATIVE 5

FIGURE 7-1

FILE I:\hill_afb\dgn\ou8\8ROD3_05\7_02_8attain305.dgn PLOT DATE/TIME 16-MAR-2005 17:49

EXPLANATION

Area of Attainment [area with groundwater contamination above Preliminary Remediation Goals (Maximum Contaminant Levels)]

N

0 500 1000

Scale in Feet

LOCATION MAP

HILL AIR FORCE BASE
OPERABLE UNIT 8

AREA OF ATTAINMENT

FIGURE 7-2

Section 8

Responsiveness Summary

8.0 RESPONSIVENESS SUMMARY

8.1 INTRODUCTION

8.1.0.1. This section presents Hill AFB responses to general public comments on the Proposed Plan. These responses are known as the Responsiveness Summary, and are a requirement of the CERCLA process. The EPA and UDEQ are required to review and concur with the responses to public comments before the ROD can be finalized.

8.1.0.2. The Responsiveness Summary consists of an introduction, an overview of Hill AFB community involvement, and a summary of the main issues identified by the public. Specific public comments and Hill AFB responses to these specific public comments are included as Appendix C-1. Copies of the actual public comments as received by Hill AFB are included as Appendix C-2.

8.2 OVERVIEW

8.2.0.1. This Responsiveness Summary provides information about the views of the community with regard to the proposed remedial actions for Hill AFB OU 8, documents how public comments have been considered during the decision-making process, and provides responses to concerns.

The public was informed of the selected remedial actions in the following ways:

- All items contained within the Administrative Record have been on file in Weber State University Library and at the Environmental Management Directorate at Hill AFB since the final version of each document was issued. The documents include the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001), *Final Feasibility Study Report for Operable Unit 8* (MWH, 2003), and the *Final Proposed Plan for Operable Unit 8* (Hill AFB, 2003).

- The notices of availability for the documents in the Administrative Record were published in the *Salt Lake Tribune*, *Ogden Standard Examiner*, *Hilltop Times*, and *Deseret News*.

- A public comment period for the Proposed Plan was held from June 23, 2003 through July 22, 2003.

- A notice announcing the public meeting was published in the *Salt Lake Tribune*, *Ogden Standard Examiner*, *Hilltop Times*, and *Deseret News*.

- A public meeting in open house format was held on July 10, 2003 at Northridge High School in Layton, Utah.

- Written comments by the public were encouraged.

8.3 BACKGROUND ON COMMUNITY INVOLVEMENT

8.3.0.1. The public participation requirements of CERCLA Sections 113(k)(2)(B)(i-v) and 117 were met. Hill AFB has a *Community Relations Plan* that was drafted in April 1997 (Hill AFB, 1997). The ongoing community relations activities include:

- A RAB working group that meets at least quarterly and includes community representatives from adjacent counties and towns.

- A mailing list for interested parties in the community.

- A bimonthly newsletter called *EnviroNews* summarizing environmental activities performed by Hill AFB.

- Visits to nearby schools to discuss environmental issues.

- Community involvement in a noise abatement program.

- Periodic briefings to local City Councils.

- Semiannual town council meetings.
- Opportunities for public comment on remedial activities.
- Support for the community for obtaining technical assistance grants.
- Administrative record and information repository.

8.4 SUMMARY OF PUBLIC COMMENTS

8.4.1 Comments on the Proposed Plan

8.4.1.1. The following section summarizes the main issues raised by the public concerning the Proposed Plan. The Hill AFB response follows each general comment.

8.4.1.2. Potential Impact on Drinking Water Aquifers. Numerous comments were received concerning the potential for OU 8 contamination to impact deeper drinking water aquifers. The public is concerned that OU 8 contamination may eventually migrate into deeper drinking water aquifers.

8.4.1.3. Response to Comment. Hill AFB has responded to this potential concern by providing information from water supply well boring logs. Based on examination of these logs (greater than 500 feet in depth) in the vicinity of OU 8, there is at least 300 feet of low permeability clay that separates the shallow aquifer from the deeper drinking water aquifers, and confines contamination to the shallow aquifer. Field evidence of this continuous clay also was obtained during drilling and installation of monitoring well U8-071 (see Figure 3-1). The clay layer at this location was encountered at approximately 120 feet bgs and was observed to be continuous through to 180 feet bgs where drilling was terminated to avoid the inherent risk of potentially advancing contamination into uncontaminated deeper aquifers. Boring logs from numerous other wells in the area indicate this clay layer is present in the entire area of the plume and is continuous. Based on this information and deep well boring logs, it is very unlikely that groundwater contamination in the shallow aquifer would impact deeper drinking water

aquifers. Further, Layton City and Weber Basin Water Conservancy District (WBWCD) both conduct regular monitoring of their drinking water supply wells to ensure the integrity of the water supply. Both agencies prepare annual Consumer Confidence Reports (CCRs) that summarize the results of this sampling. The most recent CCRs for Layton City and WBWCD are presented in Appendix D and can be found online at http://www.laytoncity.org/public1/pdf.aspx?pdf=misc/reports/2002CCR.pdf for Layton city and at http://www.weberbasin.com/water_quality_2003/ for the WBWCD.

8.4.1.4. Cleanup Timeframe. The estimated time to cleanup the contamination was of concern to some residents.

8.4.1.5. Response to Comment. Hill AFB is committed to cleaning up the contamination in the shortest time possible. The cleanup timeframes presented in the Proposed Plan were estimated using a computer model, and represent the best estimate for each alternative. Hill AFB is continually evaluating emerging technologies to determine their viability in remediating contamination. If Hill AFB identifies technologies that could accelerate the cleanup process, the ROD will be amended accordingly to incorporate this technology in the cleanup process.

8.4.1.6. Scope and Extent of Investigation. Comments were received concerning the number of investigation points used to characterize the nature and extent of contamination.

8.4.1.7. Response to Comment. More than 250 monitoring wells and 300 direct-push cone penetration test (CPT) locations have been used to characterize the extent of contamination and create a conceptual site model of OU 8 (see Figure 3-1). Boring logs from the monitoring wells and CPTs were used to compile detailed cross-sections of the site. These cross-sections can be found in the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001). Multiple groundwater samples have been collected from the wells to characterize the nature and extent of contamination at OU 8. In addition, groundwater samples were collected from multiple depths during performance of CPT field programs. The State and EPA have reviewed the data

collected and concur that it is sufficient to characterize the site and to use as a basis for comparing remedial alternatives and selecting a remedial action.

8.4.2 Comments Made During the Public Meeting

8.4.2.1. An open house public meeting for OU 8 was held from 5:00 p.m. until 8:00 p.m. on Thursday, July 10, 2003, at Northridge High School in Layton, Utah. Representatives from Hill AFB, EPA Region VIII, and UDEQ were available to explain and answer questions about the results of the investigations, health issues, and the proposed remedy for OU 8. A list of all attendees in the meeting are included in Appendix B. Public comments and Hill AFB written responses to public comments are presented in Appendix C.

REFERENCES

Fowers, 1989. Personal Communication, Fowers, Agricultural Stabilization and Conservation Service, 1989.

Hill Air Force Base (Hill AFB), 1992. Interim Record of Decision for Sodium Hydroxide Tank Site. Hill Air Force Base, Utah. 1992.

Hill Air Force Base (Hill AFB), 1997a. Final Record of Decision for an Interim Remedial Action at Operable Unit 8. Hill Air Force Base, Utah. May, 1997.

Hill Air Force Base (Hill AFB), 1997b. Final Environmental Restoration Community Relations Plan. Hill Air Force Base, Utah. December, 1997.

Hill Air Force Base (Hill AFB), 1999–2000. Report Repository, Operation and Performance Reports, Interim Remedial Action, Hydraulic Containment System, Operable Unit 8. Hill Air Force Base, Utah. July 1999–March 2000.

Hill Air Force Base (Hill AFB), 2000. Interim Remedial Action Hydraulic Containment System for Operable Unit 8, Annual Cost and Performance Analysis for July 1999 through March 2000. Hill Air Force Base, Utah. 2000.

Hill Air Force Base (Hill AFB), 2003. Final Proposed Plan for Operable Unit 8. Hill Air Force Base, Utah. June 2003.

James M. Montgomery, Consulting Engineers, Inc. (JMM), 1991a. Draft Final Baseline Risk Assessment for Operable Unit 3. Hill Air Force Base, Utah. December, 1991.

James M. Montgomery, Consulting Engineers, Inc. (JMM), 1991b. Final Site Characterization Report for a Portion of Building 225 and Site Investigation of Fill Soils at Base Supply Well 6. Hill AFB, Utah. December, 1991.

James M. Montgomery, Consulting Engineers, Inc. (JMM), 1992. Draft Final Remedial Investigation Report for Operable Unit 3 at Hill Air Force Base, Utah. April, 1992.

Montgomery Watson, 1993. Draft Final Focused RI/FS for the Refueling Vehicle Maintenance Facility (Buildings 511 & 514) at Operable Unit 3 (IRP Site ST18). Hill Air Force Base, Utah. May, 1993.

Montgomery Watson, 1995a. Final Data Summary and Recommendations Report for Operable Unit 8. Hill Air Force Base, Utah. January, 1995.

Montgomery Watson, 1995b. Final Remedial Investigation/Feasibility Study Report for Operable Unit 7. Hill Air Force Base, Utah. February, 1995.

Montgomery Watson Harza, 2001. Final Remedial Investigation Report for Operable Unit 8. Hill Air Force Base, Utah. December 2001.

MWH, 2002. Final Management Action Plan 2001. Hill Air Force Base, Utah. September 2002.

MWH, 2003. Final Feasibility Study Report for Operable Unit 8. Hill Air Force Base, Utah. March 2003.

Southard, A.R., 1983. Important Farmlands of Davis County. Utah Agricultural Experiment Station, Research Report Number 84, 5p.

URS, 2000. Plan and Report Repository – Operable Units 3, 4, & 7, January 2000 – December 2000. Hill Air Force Base, Utah. December 2000.

U.S. Environmental Protection Agency (EPA), 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final. October, 1988.

Appendix A
Identification of ARARs

TABLE A-1

IDENTIFICATION OF FEDERAL CHEMICAL-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 1 of 3)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Solid Waste Disposal Act Identification and Listing of Hazardous Waste	42 USC Sec. 6901-6987 40 CFR Part 261	Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265 and Parts 270, 271, 124 and LDRs under 40 CFR 268.	Yes/---	On-Base **Comply** **1, 2, 3, 4, 5** Off-Base **Comply** **1, 2, 3, 4, 5, 6**	**Yes. All affected alternatives will comply.** May apply to some remedy construction waste including monitoring well installation waste.
Safe Drinking Water Act National Primary Drinking Water Standards	42 USC Sec. 300g 40 CFR Part 141	Establishes health-based standards for public water systems (MCL). Meet MCLs in groundwater and surface water.	---/Yes	On-Base **Comply** **1, 2, 3, 4, 5** Off-Base **Comply** **4, 5, 6** **Do Not Comply** **1, 2, 3**	**On-Base Alternatives.** All On-Base alternatives will comply with this ARAR at the Base boundary. Within the Base boundary, due to the potential for on-going sources, some isolated areas within the existing plume extent may remain above MCLs in 30 years. An ARAR waiver and/or adoption of ACLs under R311-211-5(c) may be sought for those areas. The need for implementing this ARAR would be evaluated, at a minimum, during the statutory 5-year reviews. **Off-Base Alternatives.** Off-Base Alternatives 1, 2 and 3 would eventually comply in 150 years but this is not considered a reasonable timeframe. Off-Base Alternatives 4 and 5 will comply in approximately 65 years. Off-Base Alternative 6 will comply in 60 years.

TABLE A-1

IDENTIFICATION OF FEDERAL CHEMICAL-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Clean Water Act	33 USC Sec. 1251-1376				
Water Quality Criteria	40 CFR Part 131	Sets criteria for developing water quality standards based on toxicity to aquatic organisms and human health.	No/Yes	On-Base **Comply** **1, 2, 3, 4, 5** Off-Base **Comply** **4, 5, 6** **Do Not Comply** **1, 2, 3**	**See discussion for 40 CFR Part 141.** Relevant and appropriate because the shallow aquifer is a potential drinking water source.
National Pretreatment Standards	40 CFR Part 403	Sets standards to control pollutants which pass through or interfere with treatment processes in POTW treatment works or which may contaminate sewage sludge.	Yes/---	On-Base **Comply** **1, 2, 3, 4, 5** Off-Base **Comply** **4, 5, 6**	**Yes. Alternatives that include discharges to a POTW will comply.** Potential chemical and action-specific ARAR for discharge to a POTW.

TABLE A-1

IDENTIFICATION OF FEDERAL CHEMICAL-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 3 of 3)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Clean Air Act	42 USC Sec. 7401-7642				
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Establishes standards for ambient air quality to protect public health and welfare (including standards for particulate matter and lead).	---/Yes	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All alternatives that include air strippers as potential groundwater treatment systems will comply.** Relevant and appropriate to activities which might result in air emissions during remedial actions.
National Emission Standards for Hazardous Air Pollutants	40 CFR Part 61 Subpart A	Sets emission standards for designated hazardous pollutants.	---/Yes	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All alternatives that include air strippers as potential groundwater treatment systems will comply.** Relevant and appropriate to all remedial activities that may result in air emissions.

TABLE A-2

IDENTIFICATION OF FEDERAL ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 1 of 4)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
National Emission Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR 61	Designates substances as hazardous air pollutants and establishes emission standards.	No/Yes	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Relevant and appropriate to benzene, chloroform, trichloroethene, and toluene emissions from groundwater treatment facilities.
Solid Waste Disposal Act	42 USC Sec. 6901-6987				
Identification and Listing of Hazardous Waste	40 CFR Part 261	Defines those solid wastes which are subject to regulation as hazardous wastes and applicability of land disposal restrictions.	Yes/---	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3, 4, 5, 6**	**Yes. All alternatives will comply.** May apply to some remedy construction waste including monitoring well installation waste.
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262	Establishes standards for generators of hazardous waste.	Yes/--	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3, 4, 5, 6**	**Yes. All alternatives will comply.** May apply to some remedy construction waste including monitoring well installation waste.

TABLE A-2

IDENTIFICATION OF FEDERAL ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Solid Waste Disposal Act (continued)					
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Part 264	Establishes minimum national standards which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste.	Yes/Yes		See discussion of specific subparts.
Solid Waste Disposal Act (continued)					
• Manifest System, Record Keeping, and Reporting	Subpart E	264.71 Use of manifest system 264.72 Manifest discrepancies 264.73 Operating record	Yes/---	On-Base **Comply** **1, 2, 3, 4, 5** Off-Base **Comply** **1, 2, 3, 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to onsite waste management of generated hazardous waste by groundwater treatment facility, if any. Includes management of wastes associated with monitoring well installation.
• Releases from Solid Waste Management Units	Subpart F		No/Yes	On-Base **Comply** **1, 2, 3, 4, 5** Off-Base **Comply** **1, 2, 3**	OU 8 is a groundwater only OU. The requirements for detection of releases from Solid Waste Management Units of this potential ARAR relative to source areas have been addressed in RODs for OUs 3 and 7. The provisions of 40 CFR 264.94 are relevant and appropriate for alternatives where some contamination may remain in groundwater.

TABLE A-2

IDENTIFICATION OF FEDERAL ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 3 of 4)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
• Closure and Post-Closure	Subpart G		No/Yes	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3**	OU 8 is a groundwater only OU. The requirements of this potential ARAR relative to source areas have been addressed in RODs for OUs 3 and 7. Relevant and appropriate for alternatives where some contamination may remain in groundwater.
Solid Waste Disposal Act (continued)					
• Use and Management of Containers	Subpart I	Requirements for storage of hazardous waste in containers.	Yes/---	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3, 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to onsite waste management of generated hazardous waste by groundwater treatment facility or monitoring well installation.
• Tanks	Subpart J	Requirements for storage of hazardous waste in tanks.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to onsite waste management of generated hazardous waste by groundwater treatment facilities, if any.

TABLE A-2

IDENTIFICATION OF FEDERAL ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Land Disposal Restrictions	40 CFR Part 268	Identifies hazardous wastes that are restricted from land disposal.	Yes/---	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3, 4, 5, 6**	
Clean Water Act	33 USC Sec. 1251-1376				
National Pretreatment	40 CFR Part 403	Sets standards to control pollutants which pass through or interfere with treatment processes in publicly owned treatment works or which may contaminate sewage sludge.	Yes/---	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All alternatives will comply.** Discharge to POTW is part of the OU 8 IRA and additional systems installed an alternative.

TABLE A-3

IDENTIFICATION OF FEDERAL LOCATION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
Endangered Species Act	16 USC Sec. 1531-1543 40 CFR 6-302(h) 50 CFR Part 200 50 CFR Part 402	Requires that Federal agencies insure that any action authorized, funded, or carried by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes.** All remedial actions involving construction are in highly developed areas and therefore will not impact this ARAR.
National Historic Preservation Act	16 USC Sec. 470s 36 CFR 800	Section 106 of the National Historic Preservation Act requires Federal agencies to take into account the effects of their undertakings on historic properties.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes.** Alternative will not impact any historic places

TABLE A-4

IDENTIFICATION OF STATE CHEMICAL-SPECIFIC ARARS
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 1 of 8)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Utah Public Drinking Water Regulations	UAC R309-103-2	Establishes maximum contaminant levels for inorganic and organic chemicals.	No/Yes	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 4, 5, 6** **Do Not Comply 1, 2, 3**	Requirements are relevant and appropriate to OU 8. Some MCLs established for contaminants not Federally regulated (e.g., total dissolved solids). **On-Base Alternatives.** All On-Base alternatives will comply with this ARAR at the Base boundary. Within the Base boundary, due to the potential for on-going sources, some isolated areas within the existing plume extent may remain above MCLs. An ARAR waiver and/or adoption of ACLs under R311-211-5(c) may be necessary for those areas. The need for implementing this ARAR would be evaluated, at a minimum, during the statutory 5-year reviews. **Off-Base Alternatives.** Alternatives 1, 2 and 3 would eventually comply in 150 years but this is not considered a reasonable timeframe. Off-Base Alternatives 4 and 5 will comply in approximately 65 years. Off-Base Alternative 6 will comply in 60 years.
Utah Public Drinking Water Regulations-Secondary Standards	UAC R309-103-3	Establishes welfare-based standards for public water systems (secondary maximum contaminant levels).	No/Yes	On-Base **1, 2, 3, 4, 5** Off-Base **1, 2, 3, 4, 5, 6**	May be relevant and appropriate for inorganics not addressed by R309-1-3-2 (i.e. iron, manganese). **See discussion for R309-103-2.**

TABLE A-4

IDENTIFICATION OF STATE CHEMICAL-SPECIFIC ARARS
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 2 of 8)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Corrective Action Clean-up Standards Policy - UST and CERCLA Sites.	UAC R311-211	Lists general criteria to be considered in establishing clean-up standards including compliance with MCLs in Safe Drinking Water Act and Clean Air Act. Requires action to be taken to be protective. Requires source removal or control of source and prevention of further degradation. In the case of contamination above the MCL, if, after evaluation of all alternatives, it is determined that applicable minimum standards cannot reasonably be achieved, clean-up levels above these standards may be established on a case-by-case basis utilizing R311-211-3 and R311-211-4.	Yes/---	On-Base **Comply** **1, 2, 3, 4, 5** Off-Base **Comply** **4, 5, 6** **Do Not Comply** **1, 2, 3**	**Source Control (R311-211-2) Yes. All alternatives will comply.** Known sources have been controlled by remedial actions already performed under RODs for OUs 3 and 7, and the inclusion of the OU 8 IRA in all remedial alternatives. **Prevent Further Degradation (R311-211-4). All On-Base Alternatives comply.** Based on groundwater model results presented in Appendix C within 30 years the extent of the plume is expected to have reduced to less than 50% of its current areal extent. **Off-Base Alternatives 1 through 3 will not comply.** This is due to the predicted continued migration of the 1,2-DCA plume. **Off-Base Alternatives 4 through 6 will comply.** Compliance is achieved through containment of the 1,2 DCA plume and/or active remediation through pump and treat. **Cleanup Standards (R311-211-5)** **See discussion for R309-103-2.** The provisions of this rule for establishing higher cleanup levels would be invoked (i.e. R311-211-5(c)) as necessary if it is accepted that any of these alternatives is appropriate after evaluation of all other alternatives. The need for implementing this ARAR would be evaluated, at a minimum, during the statutory 5-year reviews.

TABLE A-4

IDENTIFICATION OF STATE CHEMICAL-SPECIFIC ARARS
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 3 of 8)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Clean-up and Risk-Based Closure Standards-RCRA, UST, and CERCLA sites	UAC R315-101	R315-101 establishes requirements to support risk-based cleanup and closure standards at sites for which remediation or removal of hazardous constituents to background levels will not be achieved. The procedures in this rule also provide for continued management of sites for which minimal risk-based standards cannot be met. Requires removal or control of the source and non-degradation beyond existing contaminant levels.	Yes/Yes	On-Base **Comply** **2, 3, 4, 5** **Do Not Comply** **1** Off-Base **Comply** **4, 5, 6** **Do Not Comply** **1, 2, 3**	**All alternatives except On- and Off-Base Alternative 1 comply under the provisions of R315-101-1(b)(4).** On and Off-Base Alternative 1 do not comply because institutional controls may not be extensive enough to address future potential risk scenarios resulting from plume migration or use of shallow groundwater. Compliance is achieved for On-Base Alternatives 2 through 5 and Off-Base Alternatives 2 through 6 by implementing institutional controls that prevent drinking water use of groundwater in the vicinity of the plume. In this case the provisions of R315-101-1(b)(4) are applicable.

TABLE A-4

IDENTIFICATION OF STATE CHEMICAL-SPECIFIC ARARS
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 4 of 8)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Clean-up and Risk-Based Closure Standards-RCRA, UST, and CERCLA sites (continued)	UAC R315-101 (continued)				**All On-Base alternatives comply with R315-101-2 Stabilization**. This has been achieved by the removal or control of known sources undertaken during remedial actions already performed under RODs for OUs 3 and 7, and the inclusion of the OU 8 IRA in all on-Base remedial alternatives. In the case of On-Base Alternatives 4 and 5 stabilization is enhanced through pump and treat. Stabilization is also achieved by Off-Base Alternatives 4 through 6. **For Off-Base Alternatives 1 through 3 stabilization is not achieved.** The TCE and 1,2-DCA plume will continue to migrate. **Non-degradation under R315-101-3. All On-Base Alternatives comply.** Based on groundwater model results presented in Appendix C within 30 years the extent of the plume is expected to have reduced significantly. **Off-Base Alternatives 1 through 3 will not comply.** This is due to the predicted continued migration of the TCE and 1,2-DCA plume. **Off-Base Alternatives 4 through 6 will comply.** Compliance is achieved through containment of the TCE and 1,2 DCA plume and/or active remediation through pump and treat.

TABLE A-4

IDENTIFICATION OF STATE CHEMICAL-SPECIFIC ARARS
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 5 of 8)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
	UAC R315-2	Criteria for the Identification and Listing of Hazardous Waste	Yes/---	On-Base **Comply** **1, 2, 3, 4, 5** Off-Base **Comply** **1, 2, 3, 4, 5, 6**	**Yes. All alternatives will comply.** Definition of hazardous waste mirrors federal definition. If wastes generated during the remediation phase are determined to contain hazardous constituents, they will be subject to these requirements.
Standards of Quality for Waters of the State	UAC R317-2	Standards for Quality for Waters of the State.	---/Yes	On-Base **4, 5** Off-Base **4, 5, 6**	**Yes. All affected alternatives will comply.** These rules are specific to Utah surface waters, though they are derived in part by using Federal criteria. See particularly the anti-degradation policy in UAC R317-2-3.
Utah Air Conservation Regulations	UAC R307-107-1	R307-107 applies to all regulated pollutants including those for which there are National Ambient Air Quality Standards. Except as otherwise provided in R307-107, emissions resulting from an unavoidable breakdown will not be deemed a violation of these regulations.	Yes/---	On-Base **Comply** **4, 5** Off-Base **Comply** **4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to alternatives which include air strippers and might reasonably be expected to become a source of air pollution.

TABLE A-4

IDENTIFICATION OF STATE CHEMICAL-SPECIFIC ARARS
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 6 of 8)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
	UAC R307-205-3	Construction and Demolition Activities. Fugitive Dust Control.	---/Yes	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to those alternatives that require clearing or levelling of land greater than one-quarter acre in size, earthmoving, excavation, or movement of trucks or construction equipment over cleared land greater than one-quarter acre in size or access haul roads.
Utah Air Conservation Regulations (continued)	UAC R307-210	The standards of performance for new stationary sources in 40 CFR 60 (1998), as amended by 63 FR 49442, 64 FR 7457, 64 FR 9257, and 64 FR 10105 are incorporated by reference.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to remedial alternatives that may discharge contaminants to air.
National Emission Standards for Hazardous Air Pollutants (NESHAP)	UAC R307-214	NESHAP are incorporated by reference (see 40 CFR 61 Subpart A).	Yes/---	On-Base **4, 5** Off-Base **4, 5, 6**	**Yes. All affected alternatives will comply.** NESHAP standards are incorporated by reference (see 40 CFR 61 Subpart A) and are applicable to alternatives that release contaminants to air.

TABLE A-4

IDENTIFICATION OF STATE CHEMICAL-SPECIFIC ARARS
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Salt Lake and Utah Counties, Ogden City and Any Nonattainment Area for PM10	UAC R307-309-4	Fugitive Emissions and Fugitive Dust.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Requires the submission of a plan that shall address fugitive dust control strategies. Substantive requirements only are applicable.
Davis and Salt Lake Counties and Ozone Nonattainment Areas: Ozone Provisions	UAC R307-325-1	No person may permit or cause volatile organic compounds (VOCs) to be spilled, discarded, stored in open containers, or handled in any other manner, which would result in evaporation in excess of that which would result from the application of reasonably available control technology (RACT) (as defined in 40 CFR 51.100(o)).	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply** Applicable to alternatives that emit VOCs. Requires use of reasonably available control technology.
	UAC R307-410-4	Documentation of Ambient Air Impacts for Hazardous Air Pollutants.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Defines limits for *De minimus* exemption status under R307-413-8. Applicable to remedial alternatives that may discharge contaminants to air.

TABLE A-4

IDENTIFICATION OF STATE CHEMICAL-SPECIFIC ARARS
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected	Compliance Comment
Permits:Exemptions and Special Provisions	UAC R307-413-8	*De minimus* emissions from Air Strippers and Soil Venting Projects. Approval is not required under R307-401 if total emissions of VOCs are less than the 5 tons per year limit defined in R307-413-2(1)(c) and hazardous air pollutants are below the levels listed in R307-410-4(1)(d).	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply**. Applicable to remedial alternatives that may discharge contaminants to air. Sampling and calculations verifying compliance must be submitted. Sampling frequency for compliance is defined.

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
Corrective Action Clean-up Standards Policy - UST and CERCLA Sites.	UAC R311-211	Lists general criteria to be considered in establishing clean-up standards including compliance with MCLs in Safe Drinking Water Act and Clean Air Act. Requires action to be taken to be protective. Requires source removal or control of source and prevention of further degradation. In the case of contamination above the MCL, if, after evaluation of all alternatives, it is determined that applicable minimum standards cannot reasonably be achieved, clean-up levels above these standards may be established on a case-by-case basis utilizing R311-211-3 and R311-211- 4.	Yes/---	On-Base **Comply** **1, 2, 3, 4, 5** Off-Base **Comply** **4, 5, 6** **Do Not Comply** **1, 2, 3**	**Source Control (R311-211-2) Yes. All alternatives will comply.** Known sources have been controlled by remedial actions already performed under RODs for OUs 3 and 7, and the inclusion of the OU 8 IRA in all remedial alternatives. **Prevent Further Degradation (R311-211-4). All On-Base Alternatives comply.** Based on groundwater model results presented in Appendix C within 30 years the extent of the plume is expected to have reduced significantly. **Off-Base Alternatives 1 through 3 will not comply.** This is due to the predicted continued migration of the TCE and 1,2-DCA plume. **Off-Base Alternatives 4 through 6 will comply.** Compliance is achieved through containment of the 1,2 DCA plume and/or active remediation through pump and treat. **Cleanup Standards (R311-211-5)** **See discussion for R309-103-2 in Table A-4.** The provisions of this rule for establishing higher cleanup levels would be invoked (i.e. R311-211-5(c)) as necessary if it is accepted that any of these alternatives is appropriate after evaluation of all other alternatives. The need for implementing this ARAR would be evaluated, at a minimum, during the statutory 5-year reviews.

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
General Requirements - Identification and Listing of Hazardous Waste	UAC R315-2	Defines those solid wastes which are subject to regulation as hazardous wastes.	Yes/---	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3, 4, 5, 6**	Determines potential waste classification and applicability of land disposal restrictions and other solid and hazardous waste rules. State counterpart of 40 CFR 261.
Hazardous Waste Generator Requirements	UAC R315-5	Establishes standards for generators of hazardous waste.	Yes/---	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3, 4, 5, 6**	Applicable to remedial alternatives involving generation of hazardous soil and debris. State counterpart of 40 CFR 262.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	UAC R315-8	Establishes minimum standards which define the acceptable management of hazardous waste for owners and operators of TSDFs.			See discussion for specific subparts below.

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
General Facility Standards	UAC R315-8-2	Describes security, inspection and personnel training.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to alternatives involving onsite treatment or disposal. State counterpart of 40 CFR 264 Subpart B.
Location standards	UAC R315-8-2.9	Describes facility siting requirements.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to alternatives involving treatment, storage or disposal of hazardous waste at onsite facilities.
Preparedness and Prevention	UAC R315-8-3	Describes communications, alarm systems and coordination with local authorities.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to onsite waste management of generated hazardous waste in the groundwater treatment system, if any. Addressed by provisions in the *Hill AFB Spill Prevention, Control and Counter Measures Plan (June 2001).*

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
Contingency Plan and Emergency Procedures	UAC R315-8-4	Requires development of a contingency plan and designation of an emergency coordinator.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to onsite waste management of generated hazardous waste in the groundwater treatment system, if any. Addressed by provisions in the *Hill AFB Spill Prevention, Control and Counter Measures Plan (June 2001).*
Manifest System, Record-Keeping, and Reporting	UAC R315-8-5	Requires manifesting, record keeping and regular reporting.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to onsite waste management of generated hazardous waste in the groundwater treatment system, if any.
Groundwater Protection	UAC R315-8-6	Describes groundwater monitoring requirements for TSDFs.	---/Yes	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3, 4, 5, 6**	**Yes. All affected alternatives will comply.** The requirements of this potential ARAR relative to source areas have been addressed in RODs for OUs 3 and 7. Relevant and appropriate for alternatives where some contamination may remain in groundwater. State counterpart of 40 CFR 264 Subpart F.

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
Closure and Post-Closure	UAC R315-8-7	Establishes closure and post-closure performance standards and plan requirements for TSDFs.	---/Yes	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3**	**Yes. All affected alternatives will comply.** The requirements of this potential ARAR relative to source areas have been addressed in RODs for OUs 3 and 7. Relevant and appropriate for alternatives where some contamination may remain in groundwater. State counterpart of 40 CFR 264 Subpart G.
Use and Management of Containers	UAC R315-8-9	Requires specific procedures for the temporary storage of hazardous wastes in containers.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to onsite waste management of generated hazardous waste by groundwater treatment facility, if any. State counterpart of 40 CFR 264 Subpart I.
Tanks	UAC R315-8-10	Requires specific procedures for the use of tanks for the treatment or temporary storage of hazardous wastes in tanks.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to onsite waste management of generated hazardous waste by groundwater treatment facility, if any. State counterpart of 40 CFR 264 Subpart I.
Corrective Action for Solid Waste Management Units	UAC R315-8-21	Establishes requirements for designation of a CAMU and defines management practices.	Yes/---		Applicable to onsite soil treatment units. However none of the final remedial alternatives include use of a CAMU. State counterpart of 40 CFR 264 Subpart S.

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 6 of 12)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
Land Disposal Restrictions	UAC R315-13	Identifies hazardous wastes that are restricted from land disposal.	Yes/---	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3, 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to storage and treatment of generated RCRA hazardous waste or soils containing RCRA-listed wastes disposed off-site. May apply to some remedy construction waste including monitoring well installation waste. State counterpart of 40 CFR 268.

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
Clean-up and Risk-Based Closure Standards	UAC R315-101	R315-101 establishes information requirements to support risk-based cleanup and closure standards at sites for which remediation or removal of hazardous constituents to background levels will not be achieved. Requires continued management of sites for which minimal risk-based standards cannot be met. Requires removal or control of the source and non-degradation beyond existing contamination levels. Requires reporting to verify compliance.	Yes/---	On-Base **Comply 2, 3, 4, 5 Do Not Comply 1** Off-Base **Comply 4, 5, 6 Do Not Comply 1, 2, 3**	**All alternatives except On- and Off-Base Alternative 1 comply under the provisions of R315-101-1(b)(4).** On and Off-Base Alternatives 1 do not comply because institutional controls will not exist to address future potential risk scenarios. Compliance is achieved for On-Base Alternatives 2 through 5 and Off-Base Alternatives 2 through 6 by implementing institutional controls that prevent drinking water use of groundwater in the vicinity of the plume. In this case the provisions of R315-101-1(b)(4) are applicable. **All On-Base alternatives comply with R315-101-2 Stabilization.** This has been achieved by the removal or control of known sources undertaken during remedial actions already performed under RODs for OUs 3 and 7, and the inclusion of the OU 8 IRA in all on-Base remedial alternatives. In the case of On-Base Alternatives 4 and 5 stabilization is enhanced through pump and treat. Stabilization is also achieved by Off-Base Alternatives 4 through 6. **For Off-Base Alternatives 1 through 3 stabilization is not achieved.** The 1,2-DCA plume will continue to migrate. **Non-degradation under R315-101-3. All On-Base Alternatives comply.** Based on groundwater model results within 30 years the extent of the plume is expected to have reduced significantly. **Off-Base Alternatives 1 through 3 will not comply.** Due to the predicted continued migration of the 1,2-DCA plume. **Off-Base Alternatives 4 through 6 will comply.**through containment of the 1,2 DCA plume.

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
Construction and performance requirements for POTWs	UAC R317-3	Sewers and wastewater treatment works.	No/Yes	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All alternatives will comply. On-Base alternatives include the OU 8 IRA which already complies.** Construction and performance requirements for remedial works will be relevant and appropriate.
Utah Pollution Discharge Elimination System (UPDES)	UAC R317-8-7	Criteria and standards for the imposition of technology-based treatment requirements and represents the minimum level of control that must be imposed in a UPDES permit.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.**
Pretreatment	UAC R317-8-8	Sets standards for discharge to a POTW.	Yes/---	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.**

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH
(Page 9 of 12)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
Air Quality	UAC R307-101-2	Defines prohibited levels of air pollution	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.**
	UAC R307-102-1	Emission of air contaminants in sufficient quantities to cause air pollution as defined in R307-101-2 is prohibited.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.**
	UAC R307-107	Except as otherwise provided in R307-107, emissions resulting from an unavoidable breakdown will not be deemed a violation of these regulations.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.**

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
	UAC R307-165-1	Emission testing will be required of all sources with established emission limitations at least once every five years.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.**
Construction and Demolition Activities.	UAC R307-205-3	Construction and Demolition Activities. Fugitive Dust Control.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes.** All alternatives will comply because cleared land area will be less than less than one-quarter acre in size in any one work zone.
Standards for Stationary Air Sources	UAC R307-210	The standards of performance for new stationary sources in 40 CFR 60 (1998), as amended by 63 FR 49442, 64 FR 7457, 64 FR 9257, and 64 FR 10105 are incorporated by reference.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.**

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
National Emission Standards for Hazardous Air Pollutants (NESHAP)	UAC R307-214	National Emission Standards for Hazardous Air Pollutants (NESHAP) are incorporated by reference.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.**
Salt Lake and Utah Counties, Ogden City and Any Nonattainment Area for PM10	UAC R307-309-4	Fugitive Emissions and Fugitive Dust.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Requires the submission of a plan that shall address fugitive dust control strategies. Substantive requirements only are applicable.
Davis and Salt Lake Counties and Ozone Nonattainment Areas: Ozone Provisions.	UAC R307-325-1	No person may permit or cause volatile organic compounds (VOCs) to be spilled, discarded, stored in open containers, or handled in any other manner, which would result in evaporation in excess of that which would result from the application of reasonably available control technology (RACT) (as defined in 40 CFR 51.100(o)).	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply.** Applicable to alternatives that emit VOCs. Requires use of reasonably available control technology (RACT).

TABLE A-5

IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs
OPERABLE UNIT 8
HILL AIR FORCE BASE, UTAH

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Alternatives Affected (Bold)	Compliance Comment
	UAC R307-410-4	Documentation of Ambient Air Impacts for Hazardous Air Pollutants.	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply**. Defines limits for *De minimus* exemption status under R307-413-8. Applicable to remedial alternatives that may discharge contaminants to air.
Permits: Exemptions and Special Provisions	UAC R307-413-8	*De minimus* emissions from Air Strippers and Soil Venting Projects. Approval is not required under R307-401 if total emissions of VOCs are less than the 5 tons per year limit defined in R307-413-2(1)(c) and hazardous air pollutants are below the levels listed in R307-410-4(1)(d).	Yes/---	On-Base **Comply 4, 5** Off-Base **Comply 4, 5, 6**	**Yes. All affected alternatives will comply**. Applicable to remedial alternatives that may discharge contaminants to air. Sampling and calculations verifying compliance must be submitted. Sampling frequency for compliance is defined.
Well Drilling Standards	UAC R655-4	Standards for drilling and abandonment of wells.	---/Yes	On-Base **Comply 1, 2, 3, 4, 5** Off-Base **Comply 1, 2, 3, 4, 5, 6**	**Yes. All alternatives will comply.** Includes such requirements as performance standards for casing joints, requirements for abandoning a well, etc. Relevant to monitoring well construction or replacement.

Appendix B
List of Attendees at the Hill Air Force Base Operable Unit 8 Open House

List of Attendees and Participants at the Hill AFB Operable Unit 8 Open House
Northridge High School, Layton, Utah
July 10, 2003
5:00 P.M. – 8:00 P.M.

Community Residents and Members of the Public

Phil Holtam

Merilee Holtam

Tina Muston

Bob Graves

David Friz

Dave Covington

Hugh Fisher

Cecilia M. Fisher

Valerie Fisher

Bob Langford

Angelica Paxman

Charles Pitchforth

David Tillson

Rachel Walfert

Lisa Roskelley (Reporter)

Restoration Advisory Board (RAB) Members

Al Herring

Scott Paxman

Louis Cooper

Rita Painter

EPA

Sandra Bourgeois

Utah Department of Environmental Quality (UDEQ)

Muhammad Slam

Dave Allison

Utah Department of Health

Marcie Hatch

Hill AFB

Bob Elliott

Steve Hicken

Charles Freeman

Jeff Watkins

Kyle Gorder

Shannon Smith

Jarrod Case

Dr. Ed Johnson

Dave Mills

Dave Harris

Barbara Fisher

Carly Brown

Gerry Henningsen

Susan Barber

Miriam Langford

MWH

Mark Plested

Craig Stevens

Robert Kamau

Douglas Oliver

Shirley Steinmacher

Appendix C
Proposed Plan Comments and Hill Air Force Base Responses to Comments

Appendix C-1
Proposed Plan Comments and Hill Air Force Base Responses to Comments

C.1.0 Public Comments and Responses

C.1.0.0.1. The following section presents written public comments received for the OU 8 Proposed Plan and Hill AFB responses to these comments. Each section lists an individual comment. The comment has been duplicated here exactly as the comment was written.

C.1.1. COMMENTS BY ANONYMOUS #1

C.1.1.0.1. Comment #1. It would be nice if this could be done in less than 65 years but if that's how long it takes it's still better than 150 years.

C.1.1.0.2. Response to Comment #1. Hill AFB is committed to cleaning up the contamination in the shortest time possible. The estimated cleanup timeframe of 65 years represents a best estimate. Further, Hill AFB is continually evaluating emerging technologies to determine their viability in remediating contamination.

C.1.1.0.3. Comment #2. I'm glad to see this being done. I'm also glad to have this opportunity to talk to these people about it and get a real story instead of rumors.

C.1.1.0.4. Response to Comment #2. Comment noted and appreciated.

C.1.2. COMMENTS BY MS. TINA MUSTON

C.1.2.0.1. Comment #1. Try to speed up the process and award a contract soon. This work needs to get started.

C.1.2.0.2. Response to Comment #1. By law, Hill AFB has up to 15 months from the date the ROD is signed to the start of remedial construction. However, Hill AFB will try to initiate construction activities as soon as practicable. There are several administrative procedures that have to be accomplished before construction can begin. These include acquisition of long-term leases with property owners to allow installation of remediation systems, public approval of the Proposed Plan, regulatory approval of this Record of Decision, federal contract procurement procedures, and preparation of technical documents for performance of the work to ensure quality and integrity.

C.1.3. COMMENTS BY MS. PAM LARSEN

C.1.3.0.1. Comment #1. I live in Layton and saw the invitation to comment in the newspaper and I would like to submit my concerns about the groundwater cleanup south of the base. My comments are mostly related to the very brief conclusions in the proposed plan under the heading Site Physical Characteristics. Maybe these questions have already been addressed in other documents not available on the web. If so, I'd like to find out where I can get the information.

The conclusions in the document seems to be substantially based on the thumbnail sketch of information about the subsurface and hydrogeology. For example, the document seems to conclude that the base is a groundwater high and that the old pond likely formed a

groundwater mound. As a result, groundwater flows both north and south of the high in sand units. The document also appears to indicate that the subsurface contains more sand on base and more clay to the south and south-west. In fact, the document indicates that a horizontally extensive clay/silt layer (aquitard) separates the shallow and deeper aquifers off base and that the clay prohibits flow between the shallow and deep zones, but details about this aquitard are no where to be found. Lots of uncertainties about the subsurface are not addressed and so I have a few comments:

1. How thick is the shallow aquifer and how thick is the clay layer/(aquitard?) that forms the base of the shallow aquifer? Does the shallow aquifer discharge contaminated groundwater in the south and west parts of the plume? How deep is groundwater in the source area and downgradient areas?

2. How much of Layton's shallow ground water is contaminated (acre feet) and do you have a storativity value for the shallow aquifer?

3. What is the quality (TDS) of the shallow groundwater?

4. How many wells, CPTS etc. in which locations have been used to validate the conceptual subsurface model and show the subsurface make-up?

5. Have any of the wells penetrated the aquitard in the contaminated zone? Have city wells or other wells been drilled through the contaminated zone?

6. Since relatively insoluable, chlorinated organics denser than water are present in groundwater and the clay/silt aquitard could be fractured, how can the Air Force conclude with such certainty that the deeper (confined?) aquifer has not been or won't become contaminated, especially in the source area where sediments are sandier and vertical hydraulic gradients in the shallow aquifer are probably directed downwards with substantial head.

7. Could the sandy units on base where the contamination is higher be releasing contamination to the deeper/confined aquifer? How deep has the contamination migrated in the source area?

8. What is the concentration of dense VOCs at the top of the confining unit in the source area?

9. Are contaminant concentrations increasing in source areas or downgradient areas?

10. What is the vertical hydraulic gradient in the shallow aquifer in the shallow aquifer source area and in downgradient areas? What are groundwater levels in both shallow and deep aquifers in collocated wells?

11. How many water wells in which locations have been sampled to show that the confined/deeper aquifer isn't contaminated? What methods were used to sample these wells?

12. How much money is the water in shallow aquifer worth? Will the Air Force pay Layton for loss of its groundwater?

13. My brother-in-law works in the office complex at the south end of the contamination plume near I-15. Is the indoor air in the area impacted by VOCs?

14. Hexavalent chromium is not very soluable, but is very mobile in the environment and is very toxic. Has hex chrome migrated to the deep/confined aquifer in the source area?

15. What is the total permeability (matrix and fracture) of the aquitard? If DNAPL was present at the top of the clay in source areas, how long would it take for contamination to travel to the confined/deeper aquifer?

16. The Air Force should also pay Layton for contaminated groundwater on base, because in my opinion (MNA - treatment by dilution) won't happen in my lifetime or my grandkids lifetime.

C.1.3.0.2. Comment #2. Thanks for the chance to comment. In my opinion a plan for cleanup of groundwater needs to based on a very sound understanding of the hydrogeology and how contaminants move in the subsurface not a bunch of generalizations based on a few well logs. The proposal also needs to be more upfront about the odds that the groundwater will ever be usable. I believe that the Air Force will never be able to remove all contamination and that the shallow groundwater is probably permanently rendered unusable in the plume area. Since contamination will never be cleaned-up, the plan needs to focus more on long-term aquifer monitoring and management and less on clean-up. Specifically, the Air Force should focus less on the downgradient cleanup and MNA voodoo modelling and more on paying Layton for its loss of natural resource, cleanup of source area contamination, characterization of the aquitard and protection of the confined aquifer.

C.1.3.0.3. Response to Comment #1. The author's comments regarding site physical characteristics and the nature and extent of contamination are addressed in more detail in other documents that are a part of the Hill AFB Administrative Record. These documents include the *Conceptual Model Report for Operable Unit 8* (, MWH 2003) and the more comprehensive *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001). Copies of both reports on CD were mailed to Ms. Larsen in July 2003. However, each of the individual comments has been addressed separately in the responses below.

1. How thick is the shallow aquifer and how thick is the clay layer/(aquitard?) that forms the base of the shallow aquifer? Does the shallow aquifer discharge contaminated groundwater in the south and west parts of the plume? How deep is groundwater in the source area and downgradient areas?

Response on aquifer thickness: The thickness of the shallow aquifer at OU 8 varies across the plume. On Base, the water table varies from 75 feet bgs along the southern Base boundary to approximately 180 feet at the northern extent of the on-Base plume. The base of the shallow aquifer varies from approximately 200 feet bgs along the southern Base

boundary to 270 feet bgs at the northern extent of the on-Base plume. Therefore, the thickness of the shallow aquifer on Base varies from 125 feet at the southern Base boundary to 90 feet at the northern extent of the plume.

Off Base, the water table varies from 75 feet bgs along the southern Base boundary to approximately 3 feet bgs in the plume area east of I-15, and 75 feet bgs west of Main Street in Layton. Therefore, the thickness of the off-Base shallow aquifer varies from approximately 200 feet along the southern Base boundary, 120 feet in the plume area east of I-15, and 125 feet west of Main Street in Layton.

Based on examination of boring logs from deep water wells (greater than 500 feet bgs) in the vicinity of OU 8, there is at least 300 feet of low permeability clay that separates the shallow aquifer from the deeper drinking water aquifers. Field evidence of this continuous clay was observed during drilling and installation of monitoring well U8-071 (see Figure 3-1). The confining clay layer was encountered at approximately 120 feet bgs and was observed to be continuous through 180 feet bgs where drilling was terminated. Boring logs from numerous other wells in the area indicate this clay layer is laterally continuous. Based on this information and deep well boring logs, it is very unlikely that groundwater contamination in the shallow aquifer would impact deeper drinking water aquifers. Further, Layton City and Weber Basin Water Conservancy District (WBWCD) both conduct regular monitoring of their drinking water supply wells to ensure the integrity of the water supply.

Response on aquifer discharge: It is not clear what the author's comment is referring to. However, shallow groundwater at OU 8 discharges in various ways. For example, field drains installed in farmers' fields in Layton are believed to have transported shallow contaminated groundwater to a retention pond at the Woodland Park office complex in Layton, creating the detached lobe of the plume north of the Layton Hills Mall. Based on analytical results of water samples collected periodically from the discharge into the retention pond, we do not believe that contaminated groundwater is currently discharging in this manner. Shallow field drains have transported shallow groundwater from off-Base areas of OU 8 to Kay's Creek southwest of Main Street in Layton. Hill AFB has collected samples from the discharge at Kay's Creek on several occasions and has found no VOCs in those samples. Hill AFB will continue to monitor the discharge into Kay's Creek to ensure that contaminants are not discharged into the creek. Shallow groundwater also discharges via evapotranspiration, and it continues to migrate downgradient. The remedy presented in this ROD is intended to prevent further migration of this contaminated groundwater.

Response on depth to groundwater: Refer to response to aquifer thickness above. Depth to groundwater in the source areas on Base is 80 to 100 feet bgs.

2. How much of Layton's shallow ground water is contaminated (acre feet) and do you have a storativity value for the shallow aquifer?

Response : Approximately three billion gallons of groundwater in Layton is contaminated as a result of releases from sources at OU 8. This is equivalent to approximately 9,000 acre-feet of water. Based on two aquifer tests performed in the shallow water table aquifer in Layton,

within areas of the OU 8 plume, the aquifer storativity is estimated to range from 0.0002 to 0.03.

3. What is the quality (TDS) of the shallow groundwater?

Response: Water quality analysis of groundwater samples from representative wells at OU 8 indicates that TDS concentrations range from 320 milligrams per liter (mg/l) to 1,200 mg/l, with an average concentration of 530 mg/l. Examination of water quality in individual wells across the site does not indicate that any notable trends in water quality are occurring as groundwater migrates through either on-Base or off-Base areas.

4. How many wells, CPTS etc. in which locations have been used to validate the conceptual subsurface model and show the subsurface make-up?

Response: More than 250 monitoring wells and 300 cone penetration testing (CPT) locations have been used to characterize the extent of contamination and create a conceptual site model of OU 8. Figure 3-1 in the ROD shows the locations of these wells and CPT locations. Boring logs from the monitoring wells and CPT locations were used to compile detailed cross-sections of the site. These cross-sections can be found in the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001). Multiple groundwater samples have been collected from each of the wells to characterize the nature and extent of contamination at OU 8.

5. Have any of the wells penetrated the aquitard in the contaminated zone? Have city wells or other wells been drilled through the contaminated zone?

Response: No wells installed by Hill AFB have penetrated through the aquitard in the contaminated zone. This is primarily due to the inherent risk of potentially advancing contamination into uncontaminated deeper aquifers. However, as described in the response to Comment #1, Hill AFB has drilled wells that have partially penetrated the aquitard to demonstrate and verify its presence, lateral continuity, and ability to deter vertical migration of contamination to deeper aquifers.

Layton City Corporation and WBWCD have drilled through the aquitard and installed water supply wells in the area. Only one of those wells is located within the extent of the OU 8 contaminant plume. As described in response to item 1, above, while it is highly unlikely that OU 8 contamination will ever reach the deeper aquifers, both Layton City Corporation and WBWCD conduct regular monitoring of these water supply wells to ensure the integrity of the drinking water supply.

6. Since relatively insoluable, chlorinated organics denser than water are present in groundwater and the clay/silt aquitard could be fractured, how can the Air Force conclude with such certainty that the deeper (confined?) aquifer has not been or won't become contaminated, especially in the source area where sediments are sandier and vertical hydraulic gradients in the shallow aquifer are probably directed downwards with substantial head.

Response: Dense non-aqueous phase liquid (DNAPL) has not been identified at OU 8. Currently, the highest concentration of TCE detected at OU 8 is 680 µg/l, which is approximately 0.05 percent of the solubility of TCE (1,280,000 µg/l), and is not indicative of a DNAPL source. Furthermore, the highest TCE concentrations detected at OU 8 typically are found near the water table.

The vertical hydraulic conductivity of the underlying confining unit is believed to be very low as this layer is defined as primarily clay. The lowest values of vertical permeability at OU 8 were reported for silty clays and clayey silts and are as low as 4.8×10^{-8} cm/sec (0.00014 ft/day). Furthermore, the low permeability units underlying the shallow aquifer are not believed to be fractured.

7. Could the sandy units on base where the contamination is higher be releasing contamination to the deeper/confined aquifer? How deep has the contamination migrated in the source area?

Response: Based on examination of contaminant distributions in the on-Base area, most of the contamination is confined in the upper portion of the shallow aquifer (i.e., within the top 40 to 60 feet of the shallow aquifer). Monitoring wells that are screened across the deeper portion of the shallow aquifer on Base have contaminant concentrations that are 1 to 2 orders of magnitude lower than those in wells screened near the water table, and are often below the MCL. The greatest depth at which contamination has been detected in the shallow aquifer on Base is 270 feet where TCE has been detected at a concentration ranging from 0.4 to 2.0 µg/l. The MCL for TCE is 5.0 µg/l.

8. What is the concentration of dense VOCs at the top of the confining unit in the source area?

Response: Dissolved phase concentrations of TCE (which is the most widespread contaminant at OU 8) in monitoring wells screened at the top of the confining layer in the source area on Base range from non-detect to 2.9 µg/l. Please refer to Figure 3-8 (on-Base cross-section) in the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001).

9. Are contaminant concentrations increasing in source areas or downgradient areas?

Response: Contaminant concentrations are actually decreasing in the source areas on Base. For example, the concentration of TCE in monitoring well WW-13 on Base decreased from the maximum detected 2,000 µg/l in 1993 to less than 380 µg/l in 2002. The contaminant concentration data from this well and others in the source area have shown decreasing concentrations through time. In downgradient areas, some wells have shown increasing concentrations that are most likely due to contaminant migration. This conclusion is based on the observation that concentrations in upgradient wells show a corresponding decline in contaminant concentrations. As an example, the concentration of 1,2-DCA in monitoring well U8-096 near I-15 decreased from 697 µg/l to 360 µg/l between April 1999 and October 2002. In the same time period, the concentration of 1,2-DCA in monitoring well U8-097, which is located 400 feet downgradient from U8-096, increased from 128 µg/l to 230 µg/l.

However, as a contaminant migrates through the aquifer, the peak concentrations seen downgradient from any particular source area successively decrease with distance from this source due to natural attenuation processes (e.g., dispersion, biodegradation).

10. What is the vertical hydraulic gradient in the shallow aquifer in the shallow aquifer source area and in downgradient areas? What are groundwater levels in both shallow and deep aquifers in collocated wells?

Response: Estimates of vertical hydraulic gradients for groundwater in the shallow aquifer were calculated using groundwater piezometric surface elevations from monitoring well pairs that are screened at different depths. Because most of these wells were not constructed for the purpose of determining vertical hydraulic gradients (i.e., as piezometer nests), the calculated values are considered estimates only. The calculated values indicate that both upward and downward gradients exist at different locations in the shallow aquifer at OU 8. Vertical hydraulic gradients are primarily downward on Base, including the source areas near the Industrial Complex. On Base, the downward gradient is strongest in the former Berman Pond/Pond 1 area, ranging from 0.55 to 0.74. Upward gradients occur in a few on-Base areas, particularly in the vicinity of the OU 8 IRA Hydraulic Containment System. Vertical gradients were downward in this area prior to operation of the IRA Hydraulic Containment System. Off Base, vertical gradients are primarily upwards. In some areas off Base, artesian conditions exist, which reflect upward gradients. Downward gradients exist in the area west of I-15 and Main Street in Layton.

The author has requested information regarding groundwater levels in both shallow and deep aquifers in collocated wells. In responding to this comment, Hill AFB assumes the term "deeper aquifers" in the author's comment refers to deeper portions of the shallow aquifer, and not the deeper drinking water aquifers. The following table summarizes groundwater elevations in some of the monitoring well pairs used to calculate the vertical hydraulic gradients. This table only presents a subset of the well pairs at OU 8 and is meant to provide a broad representation of the vertical hydraulic gradients across the OU 8 plume. A more detailed analysis can be found in the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001), which is available in the Administrative Record and has been sent to the author. Groundwater elevation measurements presented here represent previously taken single point measurements at those wells and do not necessarily represent current field conditions.

Well Pair (Shallow/deep)	General Location	Groundwater Elevation (feet) at each well, respectively	Direction of Vertical Gradient
U8-008/U8-021	Hill AFB Industrial Complex	4624.22/4622.83	Downward
WW-13/U8-017	Hill AFB Industrial Complex	4661.71/4661.44	Downward
U8-012/U-013	Hill AFB Industrial Complex	4663.23/4666.32	Upward
U3-030/U3-022	Southern Base Boundary	4740.63/4698.43	Downward
U3-061/U8-028	Hillfield Road, Layton	4671.66/4672.32	Upward
U8-029/U8-082	Off-Base in Layton	4556.47/4563.23	Upward
U8-117/U8-118	Weber State Campus area	4601.30/4602.95	Upward
U8-076/U8-112	West of I-15	4385.63/4372.93	Downward

11. How many water wells in which locations have been sampled to show that the confined/deeper aquifer isn't contaminated? What methods were used to sample these wells?

Response: There are two water wells within the OU 8 area of investigation. One of the wells is located near Northridge High School on Hill Field Road and is operated by WBWCD. The other well is located near the intersection of Antelope Drive and Hill Field Road and is operated by Layton City Corporation. Water samples are collected regularly from these wells by the operating entity via sampling ports at the well heads, and analyzed for VOCs. Details of the sampling program can be obtained from the respective operators. Both Layton City and WBWCD send out yearly summaries of the sampling results to all residents connected to their respective water systems. Based on information previously provided by the operators, VOCs associated with OU 8 have not been detected in these wells.

12. How much money is the water in shallow aquifer worth? Will the Air Force pay Layton for loss of its groundwater?

Response: To our knowledge the shallow groundwater aquifer in the area beneath Hill AFB and the city of Layton has never had a value placed on it. Layton City does not use the groundwater from this aquifer, has not acquired any rights to use water within the aquifer, and has never made any claims for damages. Therefore, the resource is still managed by the State of Utah.

13. My brother-in-law works in the office complex at the south end of the contamination plume near I-15. Is the indoor air in the area impacted by VOCs?

Response: Hill AFB contacted Ms. Larsen to determine the location of the office complex referenced in the comment. Ms. Larsen notified Hill AFB that the office complex is located just north of the Layton Hills Mall. There is a small area of groundwater contamination in the vicinity of the Layton Hills Mall beneath a stormwater retention pond. It is believed that shallow field drains used to manage groundwater in farmers' fields prior to residential development inadvertently conveyed contaminated groundwater via storm drains to the pond. Groundwater samples collected from monitoring wells that have been installed in the vicinity of the pond have shown low concentrations of TCE and 1,2-DCA, in the order of 7 to 10 µg/l. Indoor air samples have not been collected in this area. However, indoor air samples were collected in residences further north of this pond as part of the *Baseline Risk Assessment* performed in 2001, and included in the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001). At that time, the indoor air sampling program targeted areas overlying shallow contaminated groundwater, and particularly in residences where groundwater infiltration into basements was reported. The *Baseline Risk Assessment* did not find risk levels requiring mitigation.

However, Hill AFB plans to conduct additional indoor air sampling in the Fall of 2003 in areas within the known extent of the OU 8 plume where contaminated groundwater is within 25 feet of the ground surface. The data collected will be used to re-evaluate the air exposure pathways and the risks associated with exposure. Hill AFB is currently working with the State and EPA to establish a standardized technical approach for mitigating indoor air exposure where such exposure is identified.

14. Hexavalent chromium is not very soluable, but is very mobile in the environment and is very toxic. Has hex chrome migrated to the deep/confined aquifer in the source area?

Response: Hexavalent chromium has been detected in monitoring wells beneath the industrial complex area of the Base, primarily in the Building 225 area, which is the source of the hexavalent chromium. Monitoring wells in which hexavalent chromium has been detected are screened across the water table or within 20 feet of the water table. Hexavalent chromium has not been detected in deeper regions of the shallow aquifer.

15. What is the total permeability (matrix and fracture) of the aquitard? If DNAPL was present at the top of the clay in source areas, how long would it take for contamination to travel to the confined/deeper aquifer?

Response: The vertical hydraulic conductivity of the underlying confining unit is believed to be very low as this layer is defined as primarily clay. While the permeability of the confining layer has not been directly measured, vertical permeability values calculated for silty clays and clayey silts at OU 8 are as low as 4.8 x 10^{-8} cm/sec (0.00014 ft/day). Further, the low permeability units underlying the shallow aquifer are not believed to be fractured. A time of travel for DNAPL through the aquitard cannot be calculated because it would be a function of the permeability for the DNAPL, which is a function of the percent saturation of the DNAPL. As noted in the response to Comment #6, there are no indications of DNAPL at OU 8.

16. The Air Force should also pay Layton for contaminated groundwater on base, because in my opinion (MNA - treatment by dilution) won't happen in my lifetime or my grandkids lifetime.

Response: We assume the issue raised in this question is that contaminated groundwater beneath Hill AFB will eventually make its way off-Base into Layton. In 1998 extraction wells were placed at the southern boundary of Hill AFB as an IRA. These wells intercept the plume of contamination and prevent further migration of contaminated groundwater into Layton. Furthermore, as discussed in the response to Comment #12, Layton City does not use and has no plans to file for rights to use the groundwater from this aquifer.

C.1.3.0.4. Comment #2. Thanks for the chance to comment. In my opinion a plan for cleanup of groundwater needs to based on a very sound understanding of the hydrogeology and how contaminants move in the subsurface not a bunch of generalizations based on a few well logs. The proposal also needs to be more upfront about the odds that the groundwater will ever be usable. I believe that the Air Force will never be able to remove all contamination and that the shallow groundwater is probably permanently rendered unusable in the plume area. Since contamination will never be cleaned-up, the plan needs to focus more on long-term aquifer monitoring and management and less on clean-up. Specifically, the Air Force should focus less on the downgradient cleanup and MNA voodoo modelling and more on paying Layton for its loss of natural resource, cleanup of source area contamination, characterization of the aquitard and protection of the confined aquifer.

C.1.3.0.5. Response to Comment #2. The proposed groundwater cleanup action is based on a thorough understanding of the conceptual model for OU 8. As described in the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001), investigations at OU 8 have been conducted since the 1980s. More than 250 monitoring wells and 300 CPT locations have been used to characterize the extent of contamination and create a conceptual site model. Boring logs from the monitoring wells and CPT locations were used to compile detailed cross-sections of the site. These cross-sections can be found in the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001). Multiple groundwater samples have been collected from the wells to characterize the nature and extent of contamination. In addition, groundwater samples were collected from multiple depths during performance of the CPT field programs.

C.1.3.0.6. Information obtained from the boring logs and groundwater sampling results was used to construct a numerical groundwater model of the site to evaluate cleanup options and

estimate cleanup timeframes. Cleanup time estimates are considered best estimates based on available data regarding site characteristics. Model predictions cannot be guaranteed to be completely accurate, and are used as a guide or predictive tool for comparison of the effectiveness of different remediation strategies. Continued data collection and analysis will help determine whether model predictions are realized, and allow Hill AFB to make adjustments in the remedy where necessary to achieve cleanup objectives. Continued data collection will also aid in long-term aquifer monitoring by tracking plume stability and changes in contaminant concentrations, also enabling the model to be refined with time.

C.1.3.0.7. Downgradient cleanup of the plume in off-Base areas is necessary in order to prevent further degradation of groundwater. As indicated in the *Final Remedial Investigation Report for Operable Unit 8* (Montgomery Watson Harza, 2001), the 1,2-DCA plume travels faster in the subsurface than TCE. If not contained, the 1,2-DCA plume will likely continue to advance to the southwest.

C.1.3.0.8. The Air Force is committed to the cleanup of contamination and the restoration of shallow groundwater at OU 8. Based on the information obtained from monitoring wells at OU 8 and boring logs from groundwater supply wells, the deeper drinking water aquifers are separated from the shallow aquifer by at least 300 feet of clay. It is therefore very unlikely that drinking water aquifers will be affected by OU 8 contamination. Furthermore, deep drinking water wells are regularly tested to ensure the integrity of the drinking water supply.

C.1.4. COMMENTS BY MR. AL HERRING

My comments on the Final Proposed Plan for OU 8 follow. I have focused only on my concerns and questions. However, rest assured that I appreciate all the thoughtful work that has gone into both the analysis and the presentation. I will be happy to answer questions or engage in more detailed discussion if any of my points are not clear.

Comment: Wording and Organization:

1. On page 2 for the off-base preferred alternative, the comment is made that groundwater monitoring will continue to "track projected declines in contaminant concentrations over time (due to natural attenuation.)" However, the preferred alternate is pump and treat, not natural attenuation, and the parenthetical comment is confusing at best.

Response: The preferred alternative off Base is pump and treat. The statement "to track projected declines in contaminant concentrations over time (due to natural attenuation)" does not refer to natural attenuation as a treatment option/alternative (e.g., MNA). The term natural attenuation as used here refers to naturally occurring physical, chemical, and/or biological processes that will be occurring regardless of the selected alternative or remedy. Hill AFB concurs that this statement may cause confusion, and has revised the wording accordingly wherever incorporated in the ROD.

Comment: On page 2 for Site Background, there is discussion of OU 7 and the reader is told to "see Figure 1." However, OU 7 is not shown in Figure 1. (It is shown in Figure 2.)

Response: Comment has been noted. This omission will be corrected in future documents.

Comment: For all the on-base and off-base alternatives, the format used is to say that the alternative being discussed includes "all aspects" of some prior alternative, and then to repeat the features of the prior alternative, along with what might be new. This is redundant and clouds the new feature(s) of the alternate being discussed. As an example, for On-Base Alternative 3 (page 8), the statement is made that the alternative includes "All aspects of Alternative 2" and then all aspects of Alternative 2 are (unnecessarily, in my opinion) repeated, and finally the new feature for Alternative 3 ("Monitoring of parameters to verify/confirm natural attenuation.") is listed. It would shorter and clearer to just say that this alternative simply includes:

* All aspects of Alternative 2.

* Monitoring of parameters to verify/confirm natural attenuation.

The description of all alternatives could be shortened and clarified by this approach.

Response: Comment has been noted. The presentation format will be reviewed for future documentation. To avoid further confusion, each alternative has been discussed separately in the OU 8 ROD.

Comment: Risk Assessment Summary:

1. The point is made in "Current Risk" that "the Willow Bend area has been developed into residential housing, and the wetlands have been drained," with the implication being that the risk of exposure to shallow-and even surfaced-groundwater (which at one point in time exceeded the MCL for TCE) has thus gone away. But gone away to where? I am uncomfortable that some contractor has "drained the swamp" by means unknown to points unknown and without HAFB oversight, and that this somehow helps make current risk acceptable. I would conclude that it helps make the current risk unknown. It is possible that the contractor's actions have increased, rather than lowered, the exposure risk. I think the Base needs to further investigate the fate of contaminated groundwater from the Willow Bend area and, if necessary, take steps to make sure this water is not creating a new risk of downstream exposure or a new area of groundwater contamination (as evidently happened with water transported by field drains to the area now occupied by the Woodland Park office complex).

Response: A risk evaluation of the Willow Bend wetland area was conducted in April 2000 to evaluate if chemical constituents in a seep located in the former wetland area posed a risk to children playing in the area. The risk evaluation assumed that the likely exposure pathways would be accidental ingestion as a result of children coming into contact with the surface water, and inhalation of cis-1,2-DCE and TCE volatilizing from the water.

However, both exposure pathways were eliminated as soon as the wetland was drained, and therefore, the referenced "risk" is no longer present. According to the Layton City engineering department, shallow groundwater from the former wetland area was channeled into land drains that ultimately discharge to the storm water collection system, which eventually discharge to Kay's Creek.

A tracer test was conducted in 1997 by Hill AFB and verified that the network of field and land drains in Layton discharges into Kay's Creek. As a result, groundwater samples were collected at the discharge point into Kay's Creek to determine whether contaminants associated with OU 8 were being discharge into the creek. Samples were analyzed for VOCs commonly found in shallow contaminated OU 8 groundwater. No VOCs were detected in these samples. A complete account of the tracer test can be found in the Final Remedial Investigation Report for Operable Unit 8 (Montgomery Watson Harza, 2001), which is available in the Administrative Record. More recently in 2001, additional groundwater samples were collected at Kay's Creek, and no VOCs were detected. Hill AFB will continue to monitor the discharge into Kay's Creek to ensure that contaminants associated with OU 8 are not discharged into the creek.

Comment: On-Base Alternatives:

1. The "Estimated Restoration Timeframe" for all alternatives is "30-years plus." This comparison period makes it impossible to distinguish what could be a major advantage for pump and treat: a shorter time frame. (I note that the time frames used for comparing off-base alternatives go out to 150 years and that the shorter time frames for pump and treat-60 to 65 years-are a major factor in selecting one of them as the preferred alternate.) My

recommendation is that the restoration time frame for on-base alternatives also be taken out far enough that a meaningful comparison can be made.

Response to comment. Specific restoration timeframes were not provided for on-Base alternatives because ongoing sources were assumed in the modeling. This assumption was made because it is more conservative than assuming the sources decay or cease to exist at some arbitrary point in the future. Modeling indicated that the active pump and treat alternatives (On-Base Alternatives 4 and 5) reduced the size of the plume slightly faster than those alternatives without active treatment (On-Base Alternatives 1 through 3). However, once the plume shrinks to its anticipated steady state or equilibrium condition, the plume shape will change little regardless of the timeframe considered and regardless of whether a pump and treat or monitored natural attenuation alternative is selected. This would be due to known and potentially unidentified, relatively small sources continuing to feed low levels of contamination to the plume. If we used a less conservative approach and assumed a decaying source term for the modeling, then a firm estimate could have been reached for a cleanup period. Contaminant concentration time series data for monitoring wells in the source area have suggested a decaying source. If we were to use the decay rate calculated from these data, it is estimated that TCE concentrations will decrease to below the MCL in approximately 45 years. The pump and treat alternatives may decrease the cleanup times by approximately 5 years, to 40 years. However, the pump and treat options would more than double the cost of remediating on-Base groundwater.

Comment. In comparing on-base alternatives, the claim is made that Alternative 2 does not meet the "Reduction in Toxicity, Mobility, Volume" criteria, whereas Alternative 3 does. This hardly seems credible, since the only difference between the two alternatives is the amount of monitoring and data analysis. "Reduction in Toxicity, Mobility, Volume" of contaminants for these two alternatives must necessarily be the same since they both depend on the same process: natural attenuation. The only thing that changes is the "number crunching."

Response: Hill AFB concurs with the author's assessment and discussed this comment with representatives from the UDEQ and the EPA. Further, the EPA concurs that both alternatives rely on the same process – natural attenuation. However, both the EPA and UDEQ favor MNA over Limited Action as the Preferred Alternative for cleanup of on-Base groundwater because EPA considers MNA a treatment technology. The difference between the two alternatives is the additional analytes listed for MNA, including ethane, ethene, and methane. Hill AFB will retain Alternative 3 as the preferred alternative. However, with approval and concurrence of the regulatory agencies, Hill AFB will initially conduct validation sampling to determine whether the collection of these additional analytes to evaluate natural attenuation is justified in the long term. The validation sampling will include collection of ethane, ethene, and methane, in addition to analytes specified under Alternative 2. Validation sampling will be limited to the minimum 5 quarterly sampling rounds needed to conduct a statistical analysis of the data.

Based on previous basewide studies conducted by Hill AFB to evaluate natural attenuation as a cleanup option, it is highly unlikely that ethane, ethene, or methane will be detected in concentrations that would justify their collection in the long term (i.e., concentrations above the EPA's preliminary screening levels). The table below summarizes detections of ethane, ethene, and methane from previous basewide studies and presents comparisons of detected concentrations with preliminary screening concentrations (PSC) for anaerobic biodegradation processes as established by the EPA (1998).

Compound	No. of samples Basewide	No. of detections Basewide	Preliminary Screening Conc (PSC)	No. of detections above PSC	Comments
Ethane	54	1	>100 µg/l	None	(1.3 µg/l)
Ethene	34	None	>10 µg/l	None	
Methane	67	25	>500 µg/l	6	2 detections at OU 5

Of the methane detections, only 2 samples (collected from OU 5) exceeded the PSC. One sample was taken from a well at the OU 5 Phase II Aeration Curtain and is likely the result of enhanced biodegradation associated with addition of bio-polymer used during installation of this system rather than naturally occurring biodegradation.

The regulatory agencies have approved removing these additional analytes from the long term sampling list for On-Base Alternative 3 if validation monitoring demonstrates that continued collection is not necessary. In that case, the list of parameters for Alternative 3 (MNA) will be similar to that of Alternative 2 (Limited Action) but MNA will remain as the preferred alternative. Therefore, the cost differential between the two alternatives will be minimal in the short term, and insignificant over the long term.

Comment: Is the extra cost of Alternative 3 over Alternative 2 justified? I think not. I note that Alternative 2 also includes "groundwater monitoring," and I see no convincing case made that additional "monitoring of parameters to verify/confirm natural attenuation" is needed. Surely "groundwater monitoring" will be sufficient to show whether natural attenuation is proceeding as expected. I also note that Alternative 3 has a present worth cost of $5.48M, versus $4.57M for Alternative 2. However, these comparisons are for "the total project cost for 30 years of operation adjusted to net present worth," whereas the restoration time frame is "30-years plus." If the restoration time frame for natural attenuation of on-base contaminants in OU 8 is more realistically something like 150 years (as it is for the off-base contaminants), the real cost difference between these two alternatives will be ultimately be much higher than indicated. If natural attenuation ends up being the selected approach, my conclusion is that Alternative 2 would be the wiser use of taxpayer money.

Response: As outlined in the previous response, the cost differential for retaining MNA as the preferred alternative but with a reduced set of analytes versus the cost of Alternative 2 (Limited Action) will be insignificant in the long term. The short term cost differential will

be limited to additional analytical costs beyond those associated with Alternative 2 (e.g., for analysis of ethane, ethene, and methane) during the validation sampling period.

Comment: My personal feeling is that the time-frame question needs to be answered before I could comfortably say that I support natural attenuation over pump and treat. It seems possible that the base could be closed at some future point and that natural attenuation would no longer be acceptable for whatever new use there would be for the land. If this is a reasonable expectation, it would be seem best to begin more aggressive remediation now rather than later.

Response. While there are no immediate plans for Base closure, it remains a possibility in the future. However, if the Base were to be closed prior to achievement of the remedial action objectives, institutional controls that are currently in place would remain in effect to prohibit potential use of shallow contaminated groundwater, and the land cannot be transferred from DOD to another party until the site has been remediated. Further, depth to groundwater beneath the Base varies from approximately 75 feet bgs at the southern Base boundary to approximately 180 feet bgs near the northern extent of the on-Base plume. Based on air exposure pathway modeling, there would not be significant risk associated with indoor air exposure if at some point in the future houses were to be built in the Industrial Complex on Base.

As described in response to the author's comment 1, above, contaminant concentration time series data for monitoring wells in the source area have indicated a decaying source. Using the decay rate calculated from these data, it is estimated that TCE concentrations will decrease to below the MCL in approximately 45 years for On-Base Alternatives 1, 2 and 3. The pump and treat options (On-Base Alternatives 4 and 5) may decrease the cleanup times by approximately 5 years, to 40 years. However, the pump and treat options would more than double the cost of remediating on-Base groundwater.

Comment: On page 19, the unqualified statement is made that "TCE is a known cancer-causing chemical." I would assume that most people reading this statement would take it to mean that TCE causes cancer in humans. However, I note that the ATSDR ToxFAQs (CAS#79-10-6) which RAB members were given in April of 2000 states: "The International Agency for Research on Cancer (IARC) has determined that trichlorethylene is not classifiable as to human carcinogenicity." If the statement on page 19 is intended to mean that TCE is known to cause cancer in lab mice and rats, then it should be thus qualified.

Response: Agreed. Comment has been noted and this statement will be qualified wherever used in future documentation.

U.S. EPA COMMENTS ON THE DRAFT PROPOSED PLAN OPERABLE UNIT 8 - MARCH 2003 HILL AIR FORCE BASE, UTAH

GENERAL COMMENTS:

1. When referring to institutional controls throughout the document, please change the word "restrict" to "prohibit".

Response:

Comment incorporated.

2. Please explain throughout the document how the preferred remedy will effectively remediate the inorganic contaminants in the aquifer.

Response:

Inorganic contaminants have been detected in the OU 8 area of investigation, both on- and off-Base. However, with the exception of hexavalent chromium in a localized area on Base, all other inorganic contaminants have been detected sporadically and inconsistently in a few wells across OU 8, with no recognizable plumes. For hexavalent chromium, natural attenuation processes will effectively remediate this contaminant and achieve RAOs for on-Base groundwater. Only three monitoring wells, directly adjacent to Building 225, have shown hexavalent chromium above its MCL of 100 ug/l in the last two years. Therefore, implementation of Monitored Natural Attenuation will result in remediation of this contaminant.

3. Please include the direction of groundwater flow for all of the maps.

Response:

Comment incorporated.

4. The maps in this proposed plan has areas designated as "future areas of groundwater use restrictions" and others as "current areas of groundwater use restrictions". Please explain why the entire area (groundwater) around the OU 8 plume is not currently restricted.

Response:

The maps have been revised, and now only show current area of groundwater use restrictions. Since preparation of the OU 8 FS, Hill AFB requested the State Engineer to include additional areas overlying contaminated groundwater that were outside of the

areas previously restricted for groundwater use. Therefore, the term "future" groundwater use restrictions has been stricken from the proposed plan.

5. Institutional controls are a major component of both the on-base and off-base alternatives in this proposed plan. Where institutional controls are a necessary component of the remedy, the same level of enforceability and documentation is warranted as would be required for an engineered remedy. The institutional control portion of a remedy should be included in a remedy decision document subject to EPA's approval and be enforceable by EPA, just as the performance standards in a remedy decision document for the engineered portion of the remedy would be.

   As part of its oversight at NPL sites, EPA should be provided with pertinent information, including but not limited to monitoring reports, to assist in evaluating the facilities=efforts to enforce specific installation policies, procedures, or processes developed by the federal facility to meet the institutional control objective and ensure compliance and effectiveness. EPA believes it is the responsibility of the federal agency to enforce against its personnel, employees, agents, and assigns by various appropriate means including the issuance of orders, directives or other formal facility-wide systems that are binding on facility personnel, employees, assigns, contractors and agents. In addition, EPA reserves its right to take whatever other enforcement action necessary to ensure compliance with the institutional control remedy and to protect human health and the environment.

   It is prudent to consider the early implementation, monitoring, reporting requirements, and enforcement of institutional controls in order to avoid unanticipated issues at the remedy decision stage. To meet its obligation to ensure that remedies are protective, EPA will only approve CERCLA remedial decision documents if the federal agency has fully evaluated the institutional control elements of the action, included certain information about the institutional control (e.g., institutional control objectives), and commits to establish mechanisms and procedures that will be used to implement, monitor, report on, and enforce the institutional controls

Response:

We appreciate your input. We also consider institutional controls to be a significant and important portion of the preferred remedy as generally described in this document. Additional detail on the implementation and monitoring of the shallow groundwater restriction (prohibition) will be provided in the Record of Decision and in post ROD monitoring plans.

SPECIFIC COMMENTS:

1. Last Page:

Please correct the address for Hill AFB. It is incorrectly stated at the top of the page at the bottom under individuals to contact.

Response:

Comment incorporated.

2. Page 18:

In defining the term institutional controls, "deed restrictions" is listed as one of the many options. Is Hill AFB still implementing "deed restrictions" as a part of the institutional control portion of the remedy?

Response:

As part of a general definition of Institutional Controls, deed restrictions are viable options. As a general rule, Hill AFB will not use deed restrictions as an institutional control and deed restrictions will likely not be used in conjunction with OU 8. However, to avoid confusion, the definition of Institutional Controls will be modified as follows:

Institutional Controls: Institutional barriers such as regulatory restrictions, water rights restrictions, and other limits on use of Air Force property which limit access to contaminated areas or the use of contaminated groundwater.

3. Page 4, Nature and Extent of Contamination:

The second paragraph states that inorganic contaminants were detected in groundwater above their respective MCLs. Please include these inorganic contaminants in Table 1.

Response:

For the reasons stated in our response to General Comment 2, only hexavalent chromium will be added to this table in response to this comment.

4. Page 5:

The paragraph on the right hand side of the page mentions a "former pond". Please state the name of this former pond. Where is the pond located? Please identify its location in Figure 2. Is this the "Former Pond 2" which is shown in Figure 2? If so, please include a statement referring readers to Figure 1 for location of the pond.

Response:

There is no official name for the referenced pond. This pond is located, as indicated in the text, adjacent to the Woodland Park Office Complex, and is not the "Former Pond 2" referenced in Figure 2. The location of the stormwater retention pond has been added to Figure 2.

5. Page 5, Risk Assessment Summary:

Please discuss the risk associated with the inorganic contaminants which are above their respective MCLs or provide an explanation as to why this discussion has been omitted from the proposed plan.

Response:

Regarding current risks, the exposure pathways identified did not result in exposure to inorganic contaminants in the scenarios used. Regarding future risks, inorganic contaminants contributed to the overall risk associated with ingestion of contaminated groundwater, albeit this is an extremely unlikely scenario given groundwater use prohibitions under institutional controls.

6. Page 14, Table 2:

Please explain why alternative 3 meets the criteria for reduction in toxicity, mobility, and volume; and alternative 1 and 2 may meet the criteria. Please also explain the rationale for ranking alternatives 1, 2, and 3 as "meets criteria" for long-term effectiveness and permanence. How was it determined that all three of these alternatives will be effective in the long term, especially the no further action alternative.

Response:

As described in the text, On-Base Alternative 3 meets the criteria for reduction in toxicity, mobility, and volume through implementation of monitored natural attenuation (MNA), while On-Base Alternatives 1 and 2 do not meet this criteria because no action is taken (such as MNA) to reduce toxicity, mobility, and volume. Natural attenuation processes are not monitored under On-Base Alternatives 1 and 2, thus reductions in TMV cannot be verified.

The reasons for these alternatives achieving this criterion are described in the text. For further explanation, all of these alternatives were modeled using groundwater flow and contaminant transport modeling. For each of these alternatives, the modeling indicated that the plume would shrink to relatively localized areas (if sources still exist) within 20-30 years, or disappear completely (if no sources are present) over this same time frame. For all of these alternatives, the plume never migrates beyond the Base boundary.

For On-Base Alternative 1, long-term protectiveness and permanence is provided through the fact the plume remains within Hill AFB boundaries, human contact with this groundwater is extremely unlikely on Base, and the OU 8 IRA Hydraulic Containment System is effective in preventing further contaminants from migrating off Base (at the southern end of the Base).

For On-Base Alternative 2, long-term effectiveness and permanence is provided for the same reasons as On-Base Alternative 1, but with additional long-term effectiveness and permanence through use of institutional controls. Similarly, On-Base Alternative 3 provides this same long-term effectiveness and permanence with additional long-term effectiveness and permanence through implementing MNA.

7. Table 3 and Table 2:

Please explain why monitored natural attention on-base complies with ARARs and monitored natural attenuation off-base does not comply with ARARs. The same question also applies to the reduction in toxicity, mobility, and volume criteria as well as the short term effectiveness criteria.

Response:

As described in detail in the OU 8 FS, On-Base Alternative 3 complies with ARARs through monitored natural attenuation of the plume over the majority of the current extent of the on-Base plume. If there are no continuing sources, the plume will disappear in 20-30 years. If there are continuing sources, very localized areas would remain above MCLs. In this case, Hill AFB would request consideration of non-MCL cleanup goals under UAC-315-101 and UAC R311-211-3 and UAC R311-211-4.

Regarding Off-Base Alternative 3, the 1,2-DCA plume continues migrating and does not naturally attenuate in a "reasonable" time frame (modeling predicts attenuation of the 1,2-DCA plume would require at least 150 years). Therefore, it does not comply with UAC R315-101-3 (non-degradation rule).

Regarding reduction of toxicity, mobility, and volume criteria, see response to comment 6, above, for On-Base Alternative 3. Regarding Off-Base Alternative 3, this alternative does not meet this criterion through MNA because the plume continues to migrate for more than 150 plus years.

Regarding short-term effectiveness, On-Base Alternative 3 meets this criterion through MNA, and within a few years, no short-term risks will remain. However, for Off-Base Alternative 3, as no action is taken to reduce current or future risks, a borderline cancer risk associated with potential inhalation of contaminants volatilizing from the groundwater would remain for some time. However, contaminant concentrations will reduce, and these borderline cancer risks will eventually be eliminated. Therefore, this alternative may meet this criterion.

8. Figure 1:

There is a small circular plume on the map that does not have an operable unit designation. It is located near OU 11. Please indicate on the map which operable unit this small plume is associated with.

Response:

The referenced plume is considered part of OU 9. The map has been updated to include this designation.

9. Page 1 – Public Involvement process:

The beginning and ending dates of the public comment period should be re-stated as June 25, 2003 and July 25, 2003 respectively. These dates should also be changed in the "Mark Your Calendar" section.

The first sentence below the June 2003 and July 2003 calendar should be revised as "Hill AFB will make its final selection only after considering *all* public comments".

Response:

Hill AFB has elected to hold the public comment period from June 23 to July 22. These dates will be reflected in the "Mark Your Calendar" section of the Final Proposed Plan.

The comment regarding the first sentence below the calendar has been incorporated.

10. Page 2 – Off-Base:

The second bullet should be revised as "Groundwater monitoring well continue to track projected decline in contaminant concentrations over time (*due to natural attenuation*).

Response:

Comment incorporated.

11. Page 8 – On-Base Alternative 4:

To be consistent, "Pump and Treat Option 1" should be in bold.

Response:

Comment incorporated.

12. Page 9 – Off-Base Alternatives:

The sentence in the middle of this section should be revised as follows: "Alternative 3 includes additional analyses for ground water sampling to verify/confirm the occurrence of natural attenuation and track its progress".

Response:

Comment incorporated.

13. Page 12- Evaluation Criteria:

The protectiveness statement should be re-written as follows: Will this alternative protect the human health and the environment against any unacceptable risk.

Response:

Comment incorporated.

14. Last Page:

The mailing address should be changed to from 7474 Wardleigh Road to

7274 Wardleigh Road.

Response:

Comment incorporated.

Appendix C-2
Copies of Public Comments to the Proposed Plan

Comment Form

Operable Unit 8 Proposed Plan

We are constantly striving to improve the way we communicate with the community. So we can understand the effectiveness of our communication, please take a couple of minutes to answer the following questions:

How did you hear of tonight's InfoFair?

☐ Newspaper Ad ☒ Newspaper story ☐ Radio ☐ Mail ☐ Other _____

On a scale of 1 to 5, with 5 being the best and 1 being the worst, please answer the following questions:

How well was the information presented? 1 2 3 4 (5)

How well did you understand the information presented tonight? 1 2 3 (4) 5

How does this compare to other public meetings you have attended? 1 2 3 4 (5)

How could we improve the way in which the information was presented?

_____

_____

_____

OU8 Proposed Plan Comments

How well do you feel like you understand the proposal to clean up contaminated groundwater off base in ~~Layton~~?

Very well	Fairly well	Somewhat well	Not very well	Not at all
☐	(☒)	☐	☐	☐

How well do you feel like you understand the proposal to clean up contaminated groundwater on base?

Very well	Fairly well	Somewhat well	Not very well	Not at all
☐	☐	(☒)	☐	☐

Is the Air Force's proposed plan to clean up contaminated groundwater off base in Layton acceptable to you?

(Yes ☒) No ☐

If no, why not? _____

_____

_____

_____

Is the Air Force's proposed plan to clean up contaminated groundwater off base in Layton acceptable to you?

Yes ☐ No ☐

If no, why not? same as above? _____

_____

_____

_____

Over

Comment Form

Operable Unit 8 Proposed Plan

We are constantly striving to improve the way we communicate with the community. So we can understand the effectiveness of our communication, please take a couple of minutes to answer the following questions:

How did you hear of tonight's InfoFair?

☑ Newspaper Ad ☐ Newspaper story ☐ Radio ☐ Mail ☐ Other _____

On a scale of 1 to 5, with 5 being the best and 1 being the worst, please answer the following questions:

How well was the information presented? 1 2 3 4 (5)

How well did you understand the information presented tonight? 1 2 3 4 (5)

How does this compare to other public meetings you have attended? 1 2 3 4 5

How could we improve the way in which the information was presented?

I understood the information because I have worked in this field. The average person would not understand this at all

OU8 Proposed Plan Comments

How well do you feel like you understand the proposal to clean up contaminated groundwater off base in Layton?

Very well ☑ Fairly well ☐ Somewhat well ☐ Not very well ☐ Not at all ☐

How well do you feel like you understand the proposal to clean up contaminated groundwater on base?

Very well ☑ Fairly well ☐ Somewhat well ☐ Not very well ☐ Not at all ☐

Is the Air Force's proposed plan to clean up contaminated groundwater off base in Layton acceptable to you?

Yes ☑ No ☐

If no, why not? _____

Is the Air Force's proposed plan to clean up contaminated groundwater off base in Layton acceptable to you?

Yes ☑ No ☐

If no, why not? _____

Over

Comment Form

Operable Unit 8 Proposed Plan

We are constantly striving to improve the way we communicate with the community. So we can understand the effectiveness of our communication, please take a couple of minutes to answer the following questions:

How did you hear of tonight's InfoFair?

☐ Newspaper Ad ☒ Newspaper story ☐ Radio ☐ Mail ☐ Other _____

On a scale of 1 to 5, with 5 being the best and 1 being the worst, please answer the following questions:

How well was the information presented? 1 2 3 4 (5)

How well did you understand the information presented tonight? 1 2 3 4 (5)

How does this compare to other public meetings you have attended? 1 2 3 4 (5)

How could we improve the way in which the information was presented?

SHORT VIDEO'S

OU8 Proposed Plan Comments

How well do you feel like you understand the proposal to clean up contaminated groundwater off base in Layton?

Very well	Fairly well	Somewhat well	Not very well	Not at all
☐	☒	☐	☐	☐

How well do you feel like you understand the proposal to clean up contaminated groundwater on base?

Very well	Fairly well	Somewhat well	Not very well	Not at all
☐	☒	☐	☐	☐

Is the Air Force's proposed plan to clean up contaminated groundwater off base in Layton acceptable to you?

Yes	No
☒	☐

If no, why not? _____

Is the Air Force's proposed plan to clean up contaminated groundwater off base in Layton acceptable to you?

Yes	No
☒	☐

If no, why not? _____

Over

Hicken Steve T Civ OO-ALC/EMR <Steve.Hicken@HILL.af.mil>

07/14/2003 08:22 AM

To: "Craig Stevens (E-mail)" <Craig.Stevens@mwhglobal.com>, "Robert Kamau (E-mail)" <Robert.Kamau@us.mwhglobal.com>
cc:
Subject: FW: Groundwater Public comments

-----Original Message-----
From: Freeman Charles Civ OO-ALC/EM
Sent: Monday, July 14, 2003 7:29 AM
To: Hicken Steve T Civ OO-ALC/EMR
Subject: FW: Groundwater Public comments

Steve, FYI--

-----Original Message-----
From: Pjlayton4@aol.com [mailto:Pjlayton4@aol.com]
Sent: Sunday, July 13, 2003 9:28 PM
To: bob.elliott@hill.af.mil; bourgeois.sandra@epa.gov; charles.freeman@hill.af.mil; mslam@utah.gov
Subject: Groundwater Public comments

Pam Larsen
2646 East 3650 North
Layton, Utah 84040
771-2110

To Whom It May Concern:

I live in Layton and saw the invitation to comment in the newspaper and I would like to submit my concerns about the groundwater cleanup south of the base. My comments are mostly related to the very brief conclusions in the proposed plan under the heading Site Physical Characteristics. Maybe these questions have already been addressed in other documents not available on the web. If so, I'd like to find out where I can get the information.

The conclusions in the document seems to be substantially based on the thumbnail sketch of information about the subsurface and hydrogeology. For example, the document seems to conclude that the base is a groundwater high and that the old pond likely formed a groundwater mound. As a result, groundwater flows both north and south of the high in sand units. The document also appears to indicate that the subsurface contains more sand on base and more clay to the south and south-west. In fact, the document indicates that a horizontally extensive clay/silt layer (aquitard) separates the shallow and deeper aquifers off base and that the clay prohibits flow between the shallow and deep zones, but details about this aquitard are no where to be found. Lots of uncertainties about the subsurface are not addressed and so I have a few comments:

1. How thick is the shallow aquifer and how thick is the clay layer/(aquitard?) that forms the base of the shallow aquifer? Does the shallow aquifer discharge contaminated groundwater in the south and west parts of the plume? How deep is groundwater in the source area and downgradient areas?
2. How much of Layton's shallow ground water is contaminated (acre feet) and do you have a storativity value for the shallow aquifer?
3. What is the quality (TDS) of the shallow groundwater?
4. How many wells, CPTS etc. in which locations have been used to validate the conceptual subsurface model and show the subsurface make-up?
5. Have any of the wells penetrated the aquitard in the contaminated zone? Have city wells or other wells been drilled through the contaminated zone?
6. Since relatively insoluable, chlorinated organics denser than water are present in groundwater and the

clay/silt aquitard could be fractured, how can the Air Force conclude with such certainty that the deeper (confined?) aquifer has not been or won't become contaminated, especially in the source area where sediments are sandier and vertical hydraulic gradients in the shallow aquifer are probably directed downwards with substantial head.
7. Could the sandy units on base where the contamination is higher be releasing contamination to the deeper/confined aquifer? How deep has the contamination migrated in the source area?
8. What is the concentration of dense VOCs at the top of the confining unit in the source area?
9. Are contaminant concentrations increasing in source areas or downgradient areas?
10. What is the vertical hydraulic gradient in the shallow aquifer in the shallow aquifer source area and in downgradient areas? What are groundwater levels in both shallow and deep aquifers in collocated wells?
11. How many water wells in which locations have been sampled to show that the confined/deeper aquifer isn't contaminated? What methods were used to sample these wells?
12. How much money is the water in shallow aquifer worth? Will the Air Force pay Layton for loss of its groundwater?
13. My brother-in-law works in the office complex at the south end of the contamination plume near I-15. Is the indoor air in the area impacted by VOCs?
14. Hexavalent chromium is not very soluable, but is very mobile in the environment and is very toxic. Has hex chrome migrated to the deep/confined aquifer in the source area?
15. What is the total permeability (matrix and fracture) of the aquitard? If DNAPL was present at the top of the clay in source areas, how long would it take for contamination to travel to the confined/deeper aquifer?
16. The Air Force should also pay Layton for contaminated groundwater on base, because in my opinion (MNA - treatment by dilution) won't happen in my lifetime or my grandkids lifetime.

Thanks for the chance to comment. In my opinion a plan for cleanup of groundwater needs to based on a very sound understanding of the hydrogeology and how contaminants move in the subsurface not a bunch of generalizations based on a few well logs. The proposal also needs to be more upfront about the odds that the groundwater will ever be usable. I believe that the Air Force will never be able to remove all contamination and that the shallow groundwater is probably permanently rendered unusable in the plume area. Since contamination will never be cleaned-up, the plan needs to focus more on long-term aquifer monitoring and management and less on clean-up. Specifically, the Air Force should focus less on the downgradient cleanup and MNA voodoo modelling and more on paying Layton for its loss of natural resource, cleanup of source area contamination, characterization of the aquitard and protection of the confined aquifer.

Sincerely
Pam Larsen

Hicken Steve T Civ
OO-ALC/EMR
<Steve.Hicken@HILL.af.mil>

07/14/2003 08:20 AM

To: "Craig Stevens (E-mail)" <Craig.Stevens@mwhglobal.com>, "Robert Kamau (E-mail)" <Robert.Kamau@us.mwhglobal.com>
cc:
Subject: FW: COMMENTS ON OU 8 PROPOSED PLAN

-----Original Message-----
From: Freeman Charles Civ OO-ALC/EM
Sent: Friday, July 11, 2003 10:08 AM
To: Hicken Steve T Civ OO-ALC/EMR
Subject: FW: COMMENTS ON OU 8 PROPOSED PLAN

... Also from Al. Charles
-----Original Message-----
From: Al Herring [mailto:al.mary.herring@worldnet.att.net]
Sent: Monday, June 30, 2003 9:21 AM
To: Charles Freeman
Cc: Michele Straube
Subject: COMMENTS ON OU 8 PROPOSED PLAN

My comments on the Final Proposed Plan for OU 8 follow. I have focused only on my concerns and questions. However, rest assured that I appreciate all the thoughtful work that has gone into both the analysis and the presentation. I will be happy to answer questions or engage in more detailed discussion if any of my points are not clear.

A. Wording and Organization:

1. On page 2 for the off-base preferred alternative, the comment is made that groundwater monitoring will continue to "track projected declines in contaminant concentrations over time (due to natural attenuation.)" However, the preferred alternate is pump and treat, not natural attenuation, and the parenthetical comment is confusing at best.

2. On page 2 for Site Background, there is discussion of OU 7 and the reader is told to "see Figure 1." However, OU 7 is not shown in Figure 1. (It is shown in Figure 2.)

3. For all the on-base and off-base alternatives, the format used is to say that the alternative being discussed includes "all aspects" of some prior alternative, and then to repeat the features of the prior alternative, along with what might be new. This is redundant and clouds the new feature(s) of the alternate being discussed. As an example, for On-Base Alternative 3 (page 8), the statement is made that the alternative includes "All aspects of Alternative 2" and then all aspects of Alternative 2 are (unnecessarily, in my opinion) repeated, and finally the new feature for Alternative 3 ("Monitoring of parameters to verify/confirm natural attenuation.") is listed. It would shorter and clearer to just say that this alternative simply includes:

* All aspects of Alternative 2.

* Monitoring of parameters to verify/confirm natural attenuation.

The description of all alternatives could be shortened and clarified by this approach.

B. Risk Assessment Summary:

1. The point is made in "Current Risk" that "the Willow Bend area has been developed into residential housing, and the wetlands have been drained," with the implication being that the risk of exposure to shallow-and even surfaced-groundwater (which at one point in time exceeded the MCL for TCE) has thus gone away. But gone away to where? I am uncomfortable that some contractor has "drained the swamp" by means unknown to points unknown and without HAFB oversight, and that this somehow helps make current risk acceptable. I would conclude that it helps make the current risk unknown. It is possible that the contractor's actions have increased, rather than lowered, the exposure risk. I think the Base needs to further investigate the fate of contaminated groundwater from the Willow Bend area and, if necessary, take steps to make sure this water is not creating a new risk of downstream exposure or a new area of groundwater contamination (as evidently happened with water transported by field drains to the area now occupied by the Woodland Park office complex).

C. On-Base Alternatives:

1. The "Estimated Restoration Timeframe" for all alternatives is "30-years plus." This comparison period makes it impossible to distinguish what could be a major advantage for pump and treat: a shorter time frame. (I note that the time frames used for comparing off-base alternatives go out to 150 years and that the shorter time frames for pump and treat-60 to 65 years-are a major factor in selecting one of them as the preferred alternate.) My recommendation is that the restoration time frame for on-base alternatives also be taken out far enough that a meaningful comparison can be made.

2. In comparing on-base alternatives, the claim is made that Alternative 2 does not meet the "Reduction in Toxicity, Mobility, Volume" criteria, whereas Alternative 3 does. This hardly seems credible, since the only difference between the two alternatives is the amount of monitoring and data analysis. "Reduction in Toxicity, Mobility, Volume" of contaminants for these two alternatives must necessarily be the same since they both depend on the same process: natural attenuation. The only thing that changes is the "number crunching."

3. Is the extra cost of Alternative 3 over Alternative 2 justified? I think not. I note that Alternative 2 also includes "groundwater monitoring," and I see no convincing case made that additional "monitoring of parameters to verify/confirm natural attenuation" is needed. Surely "groundwater monitoring" will be sufficient to show whether natural attenuation is proceeding as expected. I also note that Alternative 3 has a present worth cost of $5.48M, versus $4.57M for Alternative 2. However, these comparisons are for "the total project cost for 30 years of operation adjusted to net present worth," whereas the restoration time frame is "30-years plus." If the restoration time frame for natural attenuation of on-base contaminants in OU 8 is more

realistically something like 150 years (as it is for the off-base contaminants), the real cost difference between these two alternatives will be ultimately be much higher than indicated. If natural attenuation ends up being the selected approach, my conclusion is that Alternative 2 would be the wiser use of taxpayer money.

4. My personal feeling is that the time-frame question needs to be answered before I could comfortably say that I support natural attenuation over pump and treat. It seems possible that the base could be closed at some future point and that natural attenuation would no longer be acceptable for whatever new use there would be for the land. If this is a reasonable expectation, it would be seem best to begin more aggressive remediation now rather than later.

Hicken Steve T Civ OO-ALC/EMR <Steve.Hicken@HILL.af.mil>

07/14/2003 08:21 AM

To: "Craig Stevens (E-mail)" <Craig.Stevens@mwhglobal.com>, "Robert Kamau (E-mail)" <Robert.Kamau@us.mwhglobal.com>
cc:
Subject: FW: ADDITIONAL COMMENT ON OU 8 FINAL PLAN

-----Original Message-----
From: Freeman Charles Civ OO-ALC/EM
Sent: Friday, July 11, 2003 10:07 AM
To: Hicken Steve T Civ OO-ALC/EMR
Subject: FW: ADDITIONAL COMMENT ON OU 8 FINAL PLAN

...From Al Herring. Charles
-----Original Message-----
From: Al Herring [mailto:al.mary.herring@worldnet.att.net]
Sent: Thursday, July 03, 2003 1:32 PM
To: Charles Freeman
Cc: Michele Straube
Subject: ADDITIONAL COMMENT ON OU 8 FINAL PLAN

Forgot one thing in my comments of June 30.

On page 19, the unqualified statement is made that "TCE is a known cancer-causing chemical." I would assume that most people reading this statement would take it to mean that TCE causes cancer in humans. However, I note that the ATSDR ToxFAQs (CAS#79-10-6) which RAB members were given in April of 2000 states: "The International Agency for Research on Cancer (IARC) has determined that trichlorethylene is not classifiable as to human carcinogenicity." If the statement on page 19 is intended to mean that TCE is known to cause cancer in lab mice and rats, then it should be thus qualified.

Al